

# INSTALLATION RESTORATION PROGRAM

## Site Investigation Report

# SITE INVESTIGATION FOR 125th FIGHTER INTERCEPTOR GROUP FLORIDA AIR NATIONAL GUARD

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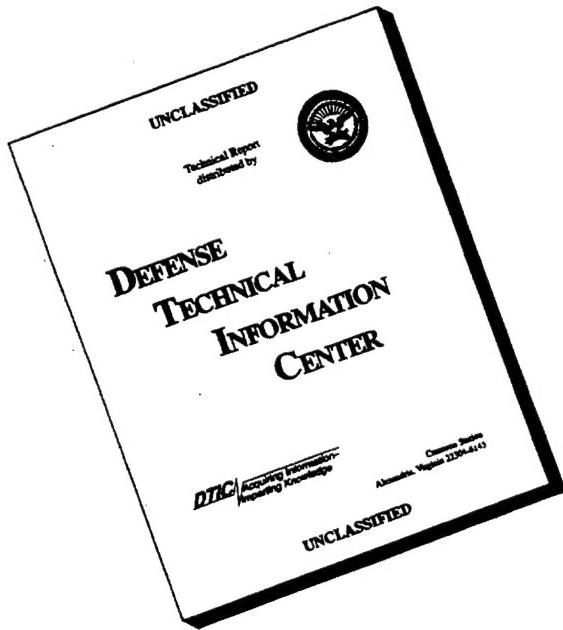
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Environmental Restoration and Waste Management Programs  
Oak Ridge, Tennessee 37831-7606  
managed by MARTIN MARIETTA ENERGY SYSTEMS, INC.  
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**INSTALLATION RESTORATION PROGRAM**

**SITE INVESTIGATION FOR**

**125TH FIGHTER INTERCEPTOR GROUP  
FLORIDA AIR NATIONAL GUARD  
JACKSONVILLE, FLORIDA**

**SITE INVESTIGATION REPORT**

**MARCH 1995**

**PREPARED FOR**

**NATIONAL GUARD BUREAU  
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WASHINGTON, D.C. 20331**

**PREPARED BY**

**CH2M HILL**

## **CONTENTS**

<b>Section</b>	<b>Page</b>
Tables	vi
Figures	x
Acronyms	xii
<b>Executive Summary</b>	<b>ES-1</b>
1      Introduction	1-1
1.1    Scope	1-1
1.2    Background	1-2
1.3    Installation Description	1-2
1.4    Site History	1-3
1.4.1    Site 1. Oil/Water Separator Inlets Along the Aircraft Parking Apron	1-4
1.4.2    Site 2. Subsurface of Aircraft Parking Apron	1-4
1.4.3    Site 3. Fire Training Areas	1-4
1.4.4    Site 4. Oil/Water Separator at the Hush House	1-5
1.4.5    Site 5. Oil/Water Separator at the Vehicle Maintenance Building	1-5
1.4.6    Site 6. Area Outside the Munitions Building	1-5
1.4.7    Site 7. Trim Pad for Aircraft Run-Up	1-6
1.4.8    Site 8. Area Surrounding Oil/Water Separator at the Wash Rack	1-6
1.5    Applicable Regulatory Guidelines	1-6
2      Field Activities	2-1
2.1    First Step of the Site Investigation	2-1
2.1.1    Temporary Well Point Installation	2-1
2.1.2    Cone Penetrometer Testing	2-2
2.1.3    Groundwater Sampling	2-3
2.1.4    Soil Sampling	2-4
2.1.5    Drainageway Sampling	2-5
2.2    Second Step of the Site Investigation	2-6
2.2.1    Temporary Well Point Installation	2-6
2.2.2    Well Point Sampling	2-7
2.2.3    Well Point Abandonment	2-8
2.2.4    Monitor Well Installation	2-8
2.2.5    Monitor Well Sampling	2-9
2.2.6    Soil Sampling	2-9
2.2.7    Drainageway Sampling	2-10
2.2.8    Aquifer Testing	2-11
2.3    Investigation-Derived Waste Management	2-12

## CONTENTS (Continued)

Section	Page
2.4 Deviations from <i>Site Investigation Sampling and Analysis Plan</i>	2-12
3 Hydrogeologic Assessment	3-1
3.1 Local Lithology	3-1
3.2 Water Elevation Data and Groundwater Flow Directions	3-3
3.2.1 First Step of the Site Investigation	3-3
3.2.2 Second Step of the Site Investigation	3-5
3.2.3 Groundwater-Surface Water Interaction	3-7
3.3 Estimated Aquifer Characteristics	3-7
3.3.1 Cone Penetrometer Testing	3-7
3.3.2 Slug Testing	3-7
4 Data Validation Results	4-1
5 Sampling and Analysis Results	5-1
5.1 First Step of the Site Investigation	5-1
5.1.1 Soil Organic Vapor Headspace Analyses	5-1
5.1.2 Floating Hydrocarbon Measurements	5-2
5.1.3 Groundwater Contaminant Concentrations	5-2
5.1.4 Soil Contaminant Concentrations	5-5
5.1.5 Drainageway Contaminant Concentrations	5-5
5.2 Second Step of the Site Investigation	5-8
5.2.1 Soil Organic Vapor Headspace Analyses	5-8
5.2.2 Floating Hydrocarbon Measurements	5-9
5.2.3 Groundwater Contaminant Concentrations	5-9
5.2.4 Soil Contaminant Concentrations	5-12
5.2.5 Drainageway Contaminant Concentrations	5-12
5.3 Background Sampling	5-13
6 Preliminary Risk Assessment	6-1
6.1 Contaminant Data Evaluation	6-1
6.2 Contaminant Fate and Transport	6-4
6.2.1 Organic Contaminants	6-5
6.2.2 Inorganic Contaminants	6-7
6.2.3 Impact of Site Contamination on Drainageways	6-8
6.3 Exposure Pathway Assessment	6-9
6.3.1 Air	6-10
6.3.2 Soils	6-11
6.3.3 Sediment	6-12
6.3.4 Surface Water	6-12

## **CONTENTS (Continued)**

<b>Section</b>		<b>Page</b>
	6.3.5 Groundwater	6-13
	6.3.6 Environmental Exposures	6-15
6.4	Toxicity Assessment	6-15
6.5	Risk Characterization	6-16
	6.5.1 Methodology	6-16
	6.5.2 Soils	6-17
	6.5.3 Surface Water and Sediments	6-18
	6.5.4 Groundwater	6-19
	6.5.5 Summary	6-20
	6.5.6 Uncertainties in Risk Estimation	6-21
6.6	Environmental Assessment	6-23
	6.6.1 Setting	6-23
	6.6.2 Receptors	6-23
	6.6.3 Contaminant Levels	6-25
	6.6.4 Summary	6-29
7	Conclusions	7-1
	7.1 Hydrogeology	7-1
	7.2 Soil Contamination	7-1
	7.3 Groundwater Contamination	7-2
	7.3.1 Site 1	7-3
	7.3.2 Site 2	7-3
	7.3.3 Site 3E	7-4
	7.3.4 Site 3W	7-5
	7.3.5 Site 4	7-5
	7.3.6 Site 5	7-5
	7.3.7 Site 6	7-6
	7.3.8 Site 7	7-6
	7.3.9 Site 8	7-6
	7.4 Drainageway Contamination	7-7
8	Recommendations	8-1
	8.1 Site 1	8-1
	8.2 Site 2	8-1
	8.3 Site 3E	8-2
	8.4 Site 3W	8-2
	8.5 Site 4	8-2
	8.6 Site 5	8-2
	8.7 Site 6	8-3
	8.8 Site 7	8-3
	8.9 Site 8	8-3

## **CONTENTS (Continued)**

**References** R-1

### **Appendix**

A	NGB/FDER Correspondence	A-1
B	Soil Boring Logs	B-1
C	Cone Penetrometer Test Data	C-1
D	Slug Test Data and Hydraulic Conductivity Calculations	D-1
E	Data Validation Technical Memorandum for the First Step of the Site Investigation	E-1
F	Data Validation Technical Memoranda for the Second Step of the Site Investigation	F-1
G	Risk Assessment Methodology	G-1

### **Attachment**

- 1 Sampling Locations for the SI

## **TABLES**

<b>Number</b>		<b>Page</b>
1-1	Summary of FAC Chapter 17-550 Drinking Water Standards (Formerly FAC Chapter 17-22)	1-8
1-2	FAC Chapter 17-70.011 Target Concentrations for Groundwater Cleanup	1-10
1-3	Summary of FAC Chapter 17-3 Surface Water Criteria	1-11
2-1	Summary of Field Activities and Samples Collected for the Site Investigation	2-14
3-1	Groundwater Elevation Data from June 2, 1989 (First Step of the SI)	3-9
3-2	Surface Water Elevations Measured at Drainageway Sampling Locations on June 1 and 2, 1989 (First Step of the SI)	3-10
3-3	Groundwater Elevation Data from June 13 and 23, 1989 (First Step of the SI)	3-11
3-4	Groundwater Elevation Data from December 4 and 5, 1989 (Second Step of the SI)	3-13
3-5	Groundwater Elevation Data from November 5 and 20, 1990, for Site 6	3-14
3-6	Slug Test Estimates of Aquifer Hydraulic Conductivity	3-15
5-1	Results of Soil Organic Vapor Headspace Analyses (First Step of the SI)	5-14
5-2	Summary of Groundwater Sample Analyses for Volatiles (First Step of the SI)	5-15
5-3	Summary of Groundwater Sample Analyses for Semi- volatiles, Polynuclear Aromatics, and EDB (First Step of the SI)	5-17
5-4	Summary of Groundwater Sample Analyses for Metals, TOC, and TSS (First Step of the SI)	5-19

## TABLES (Continued)

Number		Page
5-5	Summary of Soil Sample Analyses for Polynuclear Aromatics and Volatiles (First Step of the SI)	5-21
5-6	Summary of Soil Sample Analyses for TOC, EDB, PCBs, and Semivolatiles (First Step of the SI)	5-22
5-7	Summary of Soil Sample Analyses for Metals (First Step of the SI)	5-23
5-8	Summary of Sediment and Surface Water Sample Analyses for Volatiles (First Step of the SI)	5-24
5-9	Summary of Sediment and Surface Water Sample Analyses for Semivolatiles, EDB, and PCB (First Step of the SI)	5-25
5-10	Summary of Sediment and Surface Water Sample Analyses for Metals (First Step of the SI)	5-26
5-11	Results of Soil Organic Vapor Headspace Analyses (Second Step of the SI)	5-27
5-12	Summary of Groundwater Sample Analyses for Volatiles (Second Step of the SI)	5-28
5-13	Summary of Groundwater Sample Analyses for Metals, TDS, and Total Hardness (Second Step of the SI)	5-29
5-14	Summary of Groundwater Sample Analyses for Chromium at Site 6	5-30
5-15	Summary of Soil Sample Analyses for Metals (Second Step of the SI)	5-31
5-16	Summary of Sediment and Surface Water Sample Analyses for Metals (Second Step of the SI)	5-32
6-1	Maximum Contaminant Concentrations and Frequency of Detection in Site Investigation Groundwater Samples	6-31
6-2	Contaminant Concentrations and Frequency of Detection in Site Investigation Soil Samples	6-35

**TABLES (Continued)**

<b>Number</b>		<b>Page</b>
6-3	Maximum Contaminant Concentrations and Frequency of Detection in Site Investigation Surface Water and Sediment Samples	6-36
6-4	Site Contaminants and Associated Media	6-37
6-5	Chemical/Physical Properties of Selected Organic Chemicals	6-38
6-6	Potential Exposure Pathways	6-39
6-7	Well Inventory Information	6-41
6-8	Reference Doses and Cancer Potency Factors Used in Risk Assessment	6-42
6-9	Toxicological Profiles for Human Health Effects	6-43
6-10	Non-Carcinogenic Risks from Soil Ingestion Exposure at FANG	6-48
6-11	Non-Carcinogenic Risks from Dermal Absorption from Soils: Maximum Concentrations from All Sites	6-49
6-12	Excess Lifetime Cancer Risk from Soil Ingestion Exposure at FANG	6-50
6-13	Excess Lifetime Cancer Risk from Dermal Absorption of Soils at FANG	6-51
6-14	Comparison of Groundwater and Surface Water Maximum Concentrations with Federal Ambient Water Quality Criteria	6-52
6-15	Non-Carcinogenic Risks from Potential Future Groundwater Ingestion Exposure at FANG	6-53
6-16	Excess Lifetime Cancer Risk from Groundwater Ingestion Exposure at FANG	6-54

## **TABLES (Continued)**

<b>Number</b>		<b>Page</b>
6-17	Endangered/Threatened or Potentially Endangered/Threatened Plants That Occur or May Occur at Jacksonville International Airport, Duval County, Florida	6-55
6-18	Protected Vertebrate Species Observed or Potentially Occurring on Jacksonville International Airport Property, Duval County, Florida	6-56
6-19	Constituents Detected in Surface Waters in Excess of Water Quality Criteria	6-60

## **FIGURES**

<b>Number</b>		<b>Page</b>
ES-1	Site Location Map	ES-6
1-1	Site Location Map	1-12
1-2	Project Location Map	1-13
1-3	Topographic Detail of the Project Area	1-14
2-1	Temporary Well Point Construction Diagram	2-15
2-2	Monitor Well Construction Diagram	2-16
3-1	Generalized Geologic Section Based on Piezocone Results	3-16
3-2	General Soil Types	3-17
3-3	Groundwater Contours Based on Well Point Water Levels, First Step of the SI, June 1989	3-18
3-4	Groundwater and Surface Water Elevations at Sites 1 and 2, First Step of the SI	3-19
3-5	Groundwater and Surface Water Elevations at Site 3E, First Step of the SI	3-20
3-6	Groundwater and Surface Water Elevations at Sites 3W and 7, First Step of the SI	3-21
3-7	Groundwater and Surface Water Elevations at Site 4, First Step of the SI	3-22
3-8	Groundwater Elevations at Site 5, First Step of the SI	3-23
3-9	Groundwater Elevations at Site 6, First Step of the SI	3-24
3-10	Groundwater and Surface Water Elevations at Site 8, First Step of the SI	3-25
3-11	Groundwater Contours Based on Monitor Well Water Levels, Second Step of the SI, December 1989	3-26

## **FIGURES (Continued)**

<b>Number</b>		<b>Page</b>
3-12	Groundwater Elevations at Site 1, Second Step of the SI	3-27
3-13	Groundwater Elevations at Site 3E, Second Step of the SI	3-28
3-14	Groundwater Elevations at Site 5, Second Step of the SI	3-29
3-15	Groundwater Elevations at Site 6, Second Step of the SI	3-30
3-16	Groundwater Elevations at Site 6, November 5 and 20, 1990	3-31
3-17	Groundwater Elevations at Site 8, Second Step of the SI	3-32
5-1	Soil Organic Vapor Sampling Locations at Sites 1 and 2, Second Step of the SI	5-33
5-2	Soil Organic Vapor Sampling Location at Site 4, Second Step of the SI	5-34
6-1	Comparison of Selected Maximum Contaminant Concentrations for Soil and Sediments	6-61
6-2	Comparison of Selected Maximum Contaminant Concentrations for Groundwater and Surface Water	6-62
6-3	Physical Features	6-63
6-4	Identification of Approximate Photographed Locations	6-66
6-5	Approximate Locations of Wells in JBES Records	6-67

## ACRONYMS

AGE	Aerospace Ground Equipment
ARAR	Applicable or Relevant and Appropriate Requirements
BCF	bioconcentration factor
bls	below land surface
DD	decision document
DI	daily intake
EDB	ethylene dibromide
EPA	Environmental Protection Agency
FAC	Florida Administrative Code
FANG	Florida Air National Guard
FDER	Florida Department of Environmental Regulation
FID	flame ionization detector
FTA	fire training area
HAZWRAP	Hazardous Waste Remedial Actions Program
IRIS	Integrated Risk Information System
JBES	Jacksonville Department of Bio-Environmental Services
IRP	Installation Restoration Program
K	hydraulic conductivity
MCL	Maximum Contaminant Level
MCLG	Maximum Contaminant Level Goal
mg/kg	milligrams per kilogram
mg/l	milligrams per liter
µg/l	micrograms per liter
MW	monitor well
NGB	National Guard Bureau
OVA	organic vapor analyzer
OWS	oil/water separator
PCB	polychlorinated biphenyls
ppm	parts per million
PVC	polyvinyl chloride
QC	quality control
RfD	reference dose
SI	Site Investigation
SITM	Site Investigation Technical Memorandum
SPT	standard penetration test
SST	stainless steel
TDS	total dissolved solids
TOC	total organic carbon
TSS	total suspended solids
USGS	United States Geological Survey
UST	underground storage tank
VOA	volatile organic aromatic
WP	well point

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## ***EXECUTIVE SUMMARY***

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## **EXECUTIVE SUMMARY**

A two-step Site Investigation (SI) was conducted to evaluate the nature and extent of environmental contamination that might have resulted from past activities at eight disposal/spill sites at the 125th Fighter Interceptor Group, Florida Air National Guard (FANG) in Jacksonville, Florida. The sites included in the SI are shown on the location map in Figure ES-1 and briefly described below:

<u>Site No.</u>	<u>Description</u>
1	Oil/water separator (OWS) inlets along the aircraft parking apron
2	Subsurface of aircraft parking apron
3	Fire training areas, separated for clarity into Site 3E for the east area and Site 3W for the west area
4	OWS at the Hush House
5	OWS at the Vehicle Maintenance Building
6	Area outside the Munitions Building
7	Trim pad for aircraft run-up
8	OWS at the Wash Rack

The first step of the SI involved installation and sampling of 52 temporary well points at the sites, organic vapor headspace analyses of soil samples, and cone penetrometer testing. Each well point was also checked for floating hydrocarbons before sampling. The work provided a preliminary screening to assess whether past site activities had resulted in contamination of groundwater or soils at the sites or of surface water or

sediments in a drainageway system that runs throughout FANG. The data collected were analyzed, validated, and reviewed to evaluate the need for and direction of further SI activities.

Soil organic vapor headspace analysis readings in excess of the 500-parts-per-million criterion established in Florida Administrative Code (FAC) Chapter 17-70 were exhibited in soil samples from Sites 1, 2, 3E, 4, and 8. Neither floating hydrocarbons nor hydrocarbon sheen was detected in any well points. Groundwater samples from well points at Sites 1, 2, 3E, 4, 5, 6, and 8 showed volatile organic concentrations in excess of either the maximum contaminant levels (MCLs) established by FAC Chapter 17-550 or the guidance criterion published by the Florida Department of Environmental Regulation. Semivolatile organics and polynuclear aromatics were detected at Sites 3E, 4, and 8, and lead and/or chromium criteria (50 µg/l) were exceeded in groundwater samples from Sites 1, 2, and 6. Soil samples showed no signs of polynuclear aromatics, ethylene dibromide, or polychlorinated biphenyls; only one soil sample (from Site 4) contained a volatile organic constituent (600 µg/kg total xylenes).

The drainageway system was investigated at four reaches during the first step of the SI through collection and analysis of surface water and sediment samples. Several volatile organics were detected in Reach 1 sediment samples, and silver and mercury were reported above the criteria established for Class III surface waters in FAC Chapter 17-3. Reach 2 surface water samples had concentrations of cadmium and chromium in excess of the Class III criteria. At Reach 3, lead levels appeared high and volatile organics were detected in sediment samples. Sediment and surface water samples at Reach 4 contained volatile and semivolatile organic constituents as well as high levels of lead, chromium, and cadmium.

Based on the results from the first step of the SI, the second step included further field activities at all of the sites, including soil organic vapor headspace analyses, additional temporary well point installation and sampling, monitor well installation and sampling, drainageway sampling, and aquifer testing to obtain data for estimating hydraulic conductivity. The data were analyzed and validated, then reviewed to assess the need for further site activities.

Soil organic vapor headspace analyses were conducted using equipment that differentiates methane from other organic vapors, to assess whether the high readings from the first step of the SI could be attributable to methane gas. The readings indicated that methane may be the dominant organic vapor in the soils at FANG.

Floating hydrocarbon measurements were taken in the monitor wells and well points installed for the second step of the SI. As for the previous field activities, no floating hydrocarbons or hydrocarbon sheen was observed.

At Site 1, chromium exceeding the 50- $\mu\text{g/l}$  standard was detected in two monitor well samples at concentrations of 112 and 152  $\mu\text{g/l}$ . Chromium was not reported in soil samples in excess of the background concentration. Volatile organics were not detected in the groundwater samples collected during the second step of the SI, so the concentrations reported during the first step may indicate localized contamination.

As part of the second step of the SI at Site 2, lead analyses were made on unfiltered and field-filtered groundwater samples from two new well points; concentrations were lower than had been reported during the first step of the SI. Lead concentrations ranged from 640 to 1,200  $\mu\text{g/l}$  during the first step as compared to 1.5 to 5.9  $\mu\text{g/l}$  during the second step. No volatile organic constituents were reported in the second step, indicating that any contamination is limited to the area beneath the parking apron.

Volatile organic constituents were again detected in groundwater samples from Site 3E (175 to 207  $\mu\text{g/l}$  of total volatile organic aromatics) but in a localized area. The zone of contamination at this site appears to be isolated and may be relatively immobile as a result of site soil characteristics. No contaminants were detected at Site 3W in excess of governing criteria.

Because volatile organic concentrations were detected only at low levels at Site 4 during the first step of the SI (2 to 56  $\mu\text{g/l}$  of total volatile organic aromatics), no additional samples were collected in the subsequent field work.

Three monitor wells at Site 5 showed evidence of volatile organic contamination in excess of applicable standards, with a maximum total concentration of 65  $\mu\text{g/l}$ , but

two were wells installed by others as part of an investigation of an underground storage tank. The lack of semivolatile organic constituents at the site, such as would be expected from the vehicle fluids used there, indicates the reported contamination may be attributable to the underground tank and not past site activities.

In initial sampling at one of the monitor wells installed for the second step of the SI at Site 6, chromium was detected at 128  $\mu\text{g/l}$ , in excess of the 50- $\mu\text{g/l}$  standard. Filtered and unfiltered samples from the Site 6 monitor wells and three additional well points were subsequently analyzed; while no chromium was detected in filtered samples, chromium was found above the standard in unfiltered samples from two well points. The data indicate that the chromium detected in groundwater samples at this site is associated with sediments in the samples. Paint spills at the site may be responsible for the presence of chromium, although the probable source is reported to have been removed through excavation of soils. Contaminants at this site could potentially migrate to an adjacent wetland area.

As in the first step of the SI, Site 7 groundwater samples collected during the second step showed no evidence of contaminants in exceedance of FAC standards or other guidance criteria.

Groundwater samples from the monitor wells at Site 8 did not show concentrations of contaminants in excess of applicable standards and criteria. The volatile organics reported during the first step (49 to 645  $\mu\text{g/l}$  maximum total concentration) may indicate localized contamination at the OWS. The soil samples collected during monitor well installation did not indicate the presence of constituents that could be a continuing source of local groundwater contamination.

Sediment and surface water samples collected during the second step of the SI were obtained from drainageway locations downstream of FANG, and a background sediment sample was obtained from a point remote from the eight sites. Only barium was detected at a concentration significantly higher than background, no semivolatile organics were reported, and only one volatile organic was found above detection limits (chloroform at 1.5  $\mu\text{g/kg}$ ). Mercury was found in one surface water sample at 0.35  $\mu\text{g/l}$ , in excess of the 0.20- $\mu\text{g/l}$  Class III criterion, but no volatile or semivolatile organics were detected. The sources of the reported contaminants in the drainageway

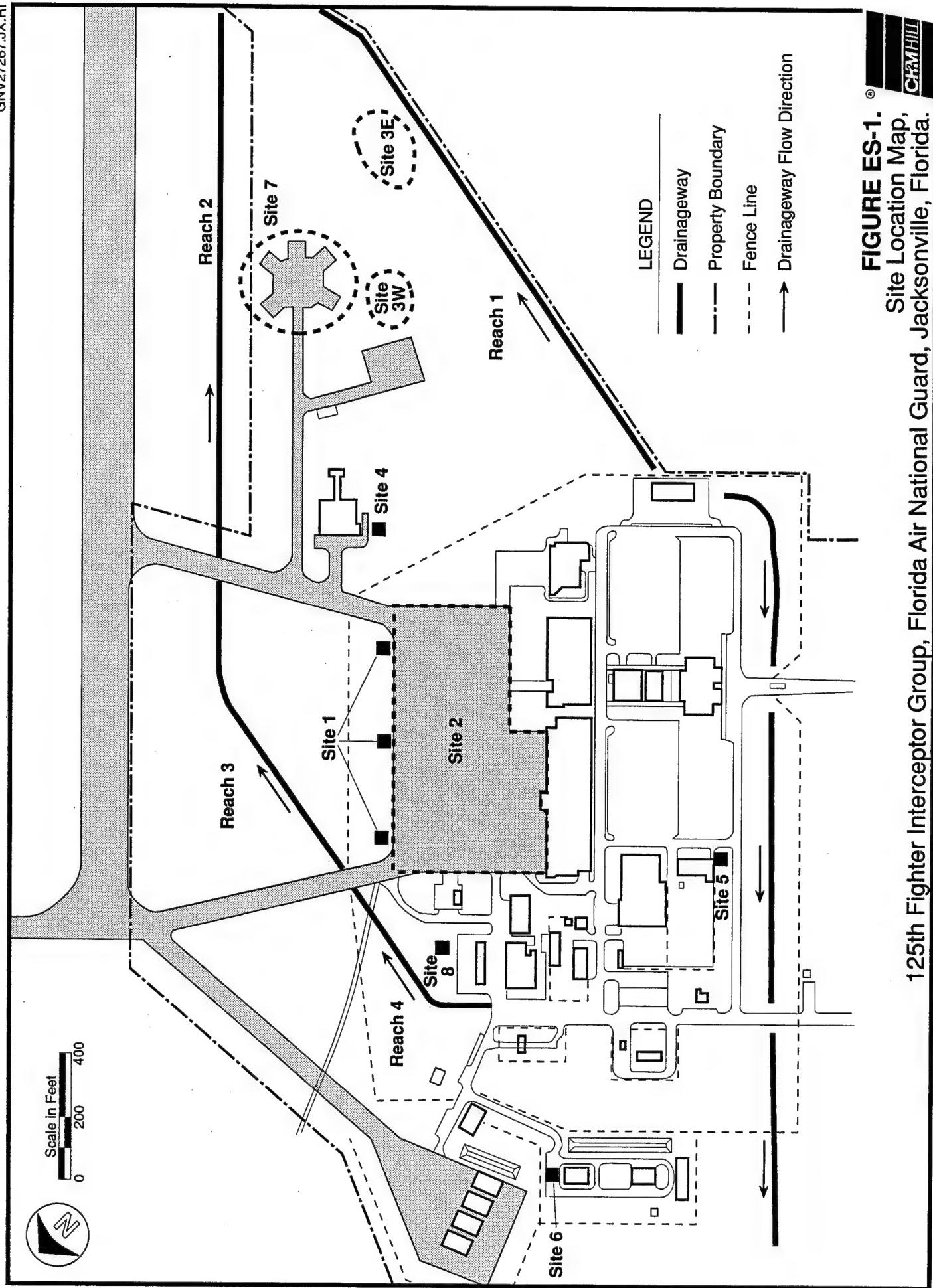
reaches at FANG and downstream of it are not clearly related to the eight sites and may be at least partially a result of current practices at FANG and runoff and discharges from Jacksonville International Airport.

A preliminary risk assessment was conducted to evaluate the potential human and environmental health hazards to both existing and potential future users of the FANG and adjoining properties. Current exposures are limited by access restrictions. Limited worker exposures to soils may occur during maintenance activities at the sites. Based on risk estimates, these exposures do not exceed acceptable risk levels.

Shallow groundwater is not used for drinking water, and future such usage may be restricted by low yields. Water quality may also be undesirable for potable use, as total dissolved solids and iron were reported at levels above secondary drinking water standards. Potential future use of the deeper aquifer near these sites as a potable water supply for base personnel was assumed to estimate reasonable maximum future exposures to groundwater contaminants. The Hazard Index was less than 1 for all sites, which indicates there is no non-carcinogenic risk from potential future ingestion of groundwater withdrawn in this zone. The highest lifetime cancer risk was  $3 \times 10^{-7}$  at Site 1. Carcinogenic risks are primarily attributed to benzene and arsenic. Arsenic concentrations were below MCLs in the shallow aquifer.

Mercury and arsenic detected in the drainageways are not likely to be a result of point source discharges from the sites. Elevated levels of mercury have been reported throughout Florida and appear to be associated with peat. Potential public exposures to surface water may occur at downstream locations where concentrations are estimated to be below criteria protective of human health.

Based on the results of the SI, no further action is recommended at Sites 1, 2, 4, 5, 6, 7, and 8 and decision documents will be prepared. No further action is recommended at Site 3W and continued groundwater monitoring of MW 3E-1 is recommended at Site 3E. A decision document for Site 3 will be prepared. The OWS at Site 5 does not appear to be the major source of the contamination reported there and further action at this site under this program is not recommended. The underground storage tank is being investigated separately.



**FIGURE ES-1.**  
Site Location Map,  
125th Fighter Interceptor Group, Florida Air National Guard, Jacksonville, Florida.

---

**SECTION 1**  
*Introduction*

---

## **1. INTRODUCTION**

The Hazardous Waste Remedial Actions Program (HAZWRAP) is assisting the National Guard Bureau (NGB) in identifying, investigating, and remediating environmental contamination through the Installation Restoration Program (IRP). CH2M HILL has been assigned under General Order 13B-97385C, Task Order Authorization No. Y-05, to investigate eight disposal/spill sites at the 125th Fighter Interceptor Group, Florida Air National Guard (FANG) in Jacksonville, Florida (see Figure 1-1), and to determine whether remediation is required. NGB is committed to resolving the status of past disposal/spill sites as quickly as possible.

### **1.1 SCOPE**

The only information available on the potential contamination at the eight disposal/spill sites before the Site Investigation (SI) began was the *Installation Restoration Program, Phase I, Records Search, 125th Fighter Interceptor Group, Florida Air National Guard, Jacksonville International Airport, Jacksonville, Florida*, by the Hazardous Materials Technical Center<sup>1</sup>. The Phase I Records Search provided a basis for developing the scope of the SI, which incorporated some of the tasks normally performed in a remedial investigation. The SI was conducted in two steps to collect the data that would support an evaluation of the nature and extent of contamination of local groundwater, soil, surface water, and sediments.

The primary purpose of the first step was to obtain data for a preliminary assessment of the nature and extent of contamination at each site and of the potential risks to human health and the environment. The second step of the SI focused on collecting more detailed data on the extent of contamination at the sites identified in the first step as requiring further information. Except as noted in this report, all SI work was performed in accordance with the *Site Investigation Sampling and Analysis Plan*<sup>2</sup> prepared by CH2M HILL in March 1989, revised in June 1989, and finalized in October 1989.

The first step of the SI was conducted from May 22 through June 23, 1989, and included temporary well point installation; soil organic vapor analyses; cone penetrometer testing; groundwater, soil, and drainageway sampling; a preliminary hydrogeologic assessment; and a preliminary receptor survey. Samples collected during the field activities were submitted for laboratory analysis during and following that period. The *Site Investigation Technical Memorandum* (SITM)<sup>3</sup> was prepared summarizing the results of the first step of the SI.

Field activities for the second step of the SI were conducted from November 27 through December 5, 1989, and included installation of additional temporary well points and monitor wells; soil, groundwater, and drainageway sampling; aquifer testing; and abandonment of all the well points installed during the SI. The sampling locations and parameters analyzed in the second step of the SI were based on the results of the first step. Additional well point installation and sampling were performed as a result of comments on the SITM<sup>3</sup> provided by the Florida Department of Environmental Regulation (FDER).

## **1.2 BACKGROUND**

The Phase I Records Search (now called a Preliminary Assessment) was completed for FANG in July 1987 by the Hazardous Materials Technical Center<sup>1</sup>. Seven past disposal/spill sites were identified and five were recommended for further study. At the request of FDER and the direction of the NGB, all seven sites and one additional site were addressed in the SI.

## **1.3 INSTALLATION DESCRIPTION**

FANG is staffed by the 125th Fighter Interceptor Group, whose mission is to provide immediate response (within 5 minutes) 24 hours a day if an unidentified aircraft enters the airspace of the United States from the east coast of Florida. The primary type of fighter plane now used at FANG is the F-16. The installation is located next to the western edge of Jacksonville International Airport, approximately 10 miles north of the center of the City of Jacksonville, and uses the airport runway (see Figure 1-2). FANG is relatively small, with approximately

30 buildings on 332 acres, and has been active continuously since it was constructed in 1968 on undeveloped swampy land.

The region in which FANG is located is characterized by high annual precipitation (over 50 inches per year). The water table is shallow and has been observed to be at or near land surface during the wet season in some areas. The major source of local drinking water, the Floridan aquifer, occurs about 300 feet below land surface (bls). Soils are fine-grained and moderately to poorly drained, with relatively low permeability. Several surface drainageways and swampy groundwater discharge areas are present at FANG (see Figure 1-3).

#### **1.4 SITE HISTORY**

The following eight disposal/spill sites at FANG were included in the SI:

<u>Site No.</u>	<u>Description</u>
1	Oil/water separator (OWS) inlets along the aircraft parking apron
2	Subsurface of aircraft parking apron
3	Fire training areas (FTAs), separated for clarity into Site 3E for the east area and Site 3W for the west area
4	OWS at the Hush House
5	OWS at the Vehicle Maintenance Building
6	Area outside the Munitions Building
7	Trim pad for aircraft run-up
8	OWS at the Wash Rack

Past activities at each site that may have led to environmental contamination are briefly described below.

#### **1.4.1 Site 1. Oil/Water Separator Inlets Along the Aircraft Parking Apron**

Site 1 consists of the areas surrounding three OWS inlets at the northern edge of the FANG aircraft parking apron. The inlets drain to an OWS to the north that discharges into a nearby surface drainageway. The inlets must be opened manually to collect surface runoff and fuel spills. Reportedly, the inlets have not always been opened when a spill occurred, which allowed runoff to flow over and around them into a grassy area to the north.

Runoff is reported to have contained spilled fuels (e.g., JP-4), solvents, and cleaners. Spills of up to 100 gallons of JP-4 reportedly occurred frequently. The F-106 planes used at FANG from 1974 to early 1987 reportedly leaked large quantities of fuels.

#### **1.4.2 Site 2. Subsurface of Aircraft Parking Apron**

When a trench was excavated through the concrete aircraft parking apron in 1980 or 1981 to repair electrical conduit, workers were reportedly overcome by fumes. Respiratory protection was necessary for the workers to finish repairing the electrical conduit and patching the concrete. Because there are no known underground fuel storage tanks or fuel supply lines underneath the parking apron, seepage of fuel spills through pavement joints is the suspected source of contamination.

#### **1.4.3 Site 3. Fire Training Areas**

Site 3 is located in the eastern portion of FANG and includes two shallow, unlined, earthen pits used for fire training from 1968 to 1984, when fire training activities at FANG ceased. The easternmost FTA (Site 3E) was used most recently, from the mid-1970s until 1984. The original FTA to the west (Site 3W) was used from 1968 to the mid-1970s.

Three to four 55-gallon drums of flammable liquids, including JP-4, spent solvents, used oils, and slop wastes, were reportedly burned during each fire training exercise.

#### **1.4.4 Site 4. Oil/Water Separator at the Hush House**

Site 4 consists of the area surrounding an OWS on the south side of the Hush House. The OWS is located in the eastern section of FANG and discharges to a nearby surface drainageway. When F-106 planes were being used at the installation, the large quantities of fuel that leaked from these aircraft reportedly caused the OWS to overflow. Waste fuel, solvents, and oil have reportedly been discharged to the OWS and overflowed into the nearby drainageway.

#### **1.4.5 Site 5. Oil/Water Separator at the Vehicle Maintenance Building**

Site 5 is located at the southern edge of FANG, south of the Vehicle Maintenance Building and next to a surface drainageway. The site consists of the area surrounding the OWS, which is designed to collect drainage and spills from the floor drain of the Vehicle Maintenance Building. Materials used during maintenance that could have drained into the OWS include oil, fuel, transmission fluid, solvents, and battery electrolyte. No major spills have been reported at this site. The nearby drainageway appears to contain water only when it rains.

#### **1.4.6 Site 6. Area Outside the Munitions Building**

The Munitions Building is at the western edge of FANG. Between approximately 1968 and 1980, small amounts of solvents, lacquer thinner, and paint were reportedly poured on the ground next to the back door of the building. Approximately 5 years ago, about 6 inches of soil visibly contaminated with paint were excavated and removed.

#### **1.4.7 Site 7. Trim Pad for Aircraft Run-Up**

The concrete trim pad is located in the eastern portion of FANG, near the FTAs at Site 3, and has been used for trimming jet engines since the installation was constructed in 1968. A surface drainageway runs along the northern edge of the site. During the period when F-106 planes were used, JP-4 frequently leaked onto the trim pad during aircraft run-up. Spills of up to 400 gallons of fuel reportedly occurred and were washed off the pad with fire hoses.

#### **1.4.8 Site 8. Area Surrounding Oil/Water Separator at the Wash Rack**

Various solvents and cleaners have been used at the Wash Rack, a building located west of the aircraft parking apron. An OWS to the west of the building receives flows from its floor drain and discharges into a nearby surface drainage-way. The OWS also receives drainage from the nearby Aerospace Ground Equipment (AGE) Storage Building, where generators are kept. Fuel, transmission fluid, and oil may have been discharged to the OWS from these buildings. The OWS has overflowed in the past.

Before the OWS was constructed around 1980, two man-made separation ponds were in use at this site. The ponds were filled and the OWS was built on top of one of them.

### **1.5 APPLICABLE REGULATORY GUIDELINES**

Federal standards, requirements, or criteria that are Applicable or Relevant and Appropriate Requirements (ARARs) will be applied unless state ARARs are more stringent. State regulations applicable to the type of contamination expected to be found at the sites have been identified, but the agencies will continue to be consulted to ensure all requirements are met.

The shallow groundwater at FANG falls within the classification of a G-II aquifer as defined in Florida Administrative Code (FAC) Chapter 17-3. As a result, evaluation of the condition of the groundwater must be based on state drinking water standards. The drinking water standards specified in FAC Chapter 17-550

(formerly FAC Chapter 17-22) were derived from federal standards and are summarized in Table 1-1. FAC Chapter 17-70 addresses petroleum contamination site cleanup criteria; target concentrations from petroleum contaminants in groundwater are summarized in Table 1-2. An internal 1989 FDER guidance document<sup>4</sup> will also be used to evaluate groundwater contamination at FANG.

Soil hydrocarbon contamination is addressed in FAC Chapter 17-70; the criterion for soil contamination under FAC Chapter 17-70.003 is based on headspace analysis of soil using an organic vapor analysis (OVA) instrument with a flame ionization detector (FID) in survey mode. Following the procedure outlined in Chapter 17-70.003, soil is considered excessively contaminated if the reading on the analytical instrument is greater than 500 parts per million (ppm).

General water quality criteria for all surface waters are listed in FAC Chapter 17-3.061, while Chapter 17-3.121 provides criteria for Class III surface waters. The surface waters in the drainageways at FANG are considered Class III, which is defined as waters used for recreation and propagation and maintenance of a healthy, well balanced population of fish and wildlife. Applicable surface water quality criteria are listed in Table 1-3.

**Table 1-1**  
**SUMMARY OF FAC CHAPTER 17-550 DRINKING WATER STANDARDS**  
**(FORMERLY FAC CHAPTER 17-22)**

Primary Drinking Water Standard	Maximum Contaminant Level (MCL)
Inorganics	
Arsenic	0.05 mg/l
Barium	1 mg/l
Cadmium	0.010 mg/l
Chromium	0.05 mg/l
Fluoride	4.0 mg/l
Lead	0.05 mg/l
Mercury	0.002 mg/l
Nitrate (as N)	10 mg/l
Selenium	0.01 mg/l
Silver	0.05 mg/l
Sodium	160.0 mg/l
Turbidity	1.0 NTU <sup>a</sup>
Pesticides	
Endrin	2 µg/l
Lindane	4 µg/l
Methoxychlor	100 µg/l
Toxaphene	5 µg/l
2,4-D	100 µg/l
2,4,5-TP (Silvex)	10 µg/l
Coliform Bacteria <sup>b</sup>	1 colony/100 ml
Radionuclides	
Combined Radium 226 & 228	5 pCi/l
Gross Alpha	15 pCi/l
Beta and Photon Radioactivity (Man-Made Radionuclides)	4 millirem/year
Total Trihalomethanes (Sum of Bromoform, Bromodichloromethane, Dibromochloromethane, Chloroform)	0.1 mg/l
Volatile Organics	
Trichloroethene	3 µg/l
Tetrachloroethene	3 µg/l

**Table 1-1**  
**(continued)**

Primary Drinking Water Standard	Maximum Contaminant Level (MCL)
<b>Volatile Organics</b>	
Carbon Tetrachloride	3 µg/l
Vinyl Chloride	1 µg/l
1,1,1-Trichloroethane	200 µg/l
1,2-Dichloroethane	3 µg/l
Benzene	1 µg/l
Ethylene Dibromide	0.02 µg/l
p-Dichlorobenzene	77.5 µg/l
1,1-Dichloroethene	7 µg/l
<b>Secondary Drinking Water Standard</b>	
Chloride	250 mg/l
Color	15 color units
Copper	1 mg/l
Corrosivity	-0.2 to +0.2 Langelier index <sup>c</sup>
Foaming Agents	0.5 mg/l
Iron	0.3 mg/l
Manganese	0.05 mg/l
Odor	3 (threshold odor number)
pH (at collection point)	6.5 - 8.5
Sulfate	250 mg/l
Total Dissolved Solids	500 mg/l <sup>d</sup>
Zinc	5 mg/l

<sup>a</sup>MCL is 5 NTU for average of 2 consecutive days or longer if proven to not reduce water quality.

<sup>b</sup>For membrane filter technique, one/100 ml is the average per sampling period. Four/100 ml in more than one sample if 20 samples or less are analyzed per sampling period; four/100 ml in more than 5% of samples if 20 samples or more are analyzed per sampling period.

<sup>c</sup>May be different if stabilizers are used.

<sup>d</sup>More than 500 mg/l is acceptable if no other MCL is exceeded.

**Table 1-2**  
**FAC CHAPTER 17-70.011 TARGET CONCENTRATIONS**  
**FOR GROUNDWATER CLEANUP**

Contaminant	Concentration (in $\mu\text{g/l}$ )
Benzene	1.0
1,2-Dichloroethane	3.0
1,2-Dibromoethane (EDB)	0.02
Total Volatile Organic Aromatics	50.0
Lead	50.0
Polynuclear Aromatic Hydrocarbons (excluding Naphthalenes)	10.0
Total Naphthalenes	100

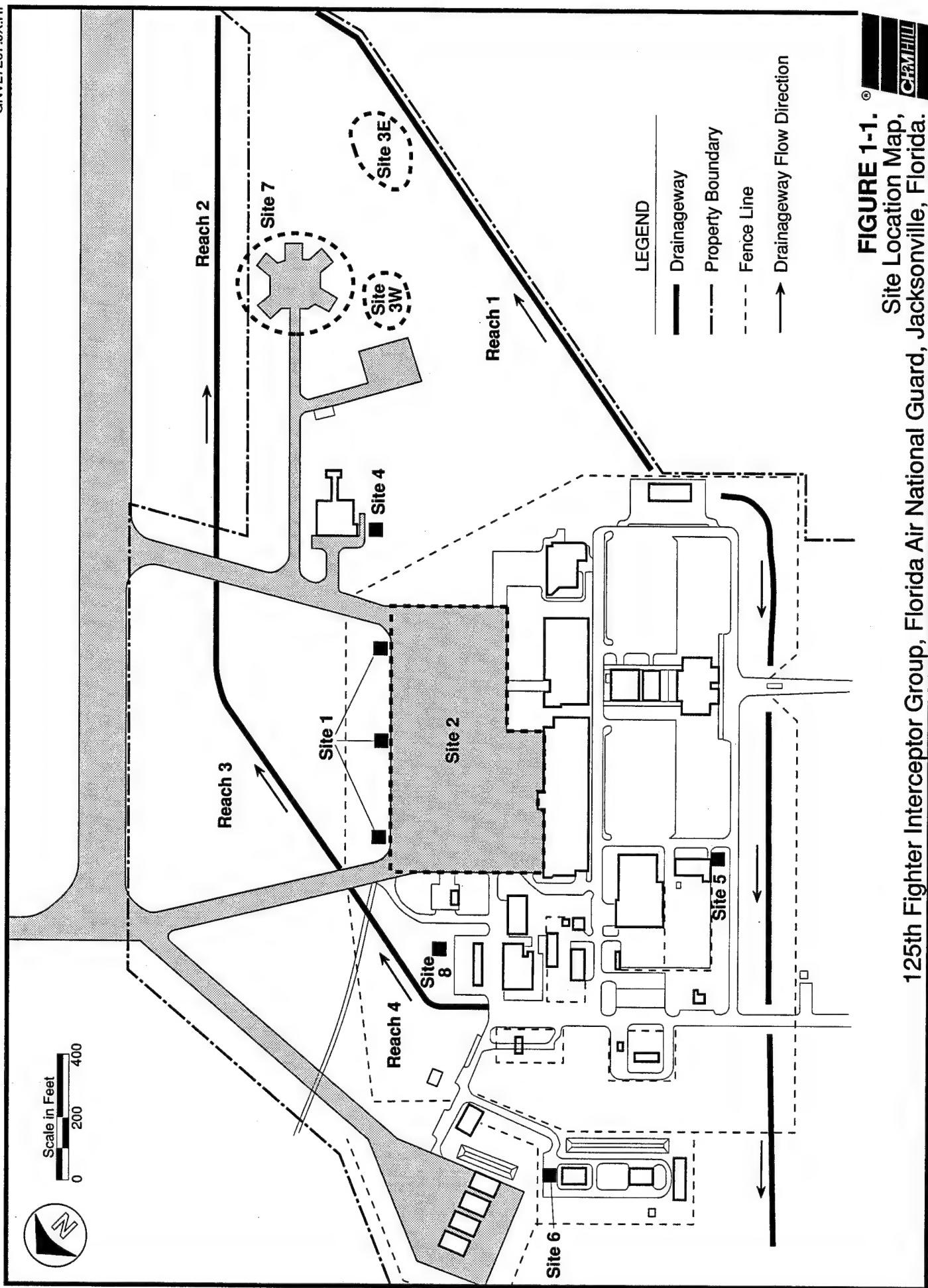
**Table 1-3**  
**SUMMARY OF FAC CHAPTER 17-3 SURFACE WATER CRITERIA**

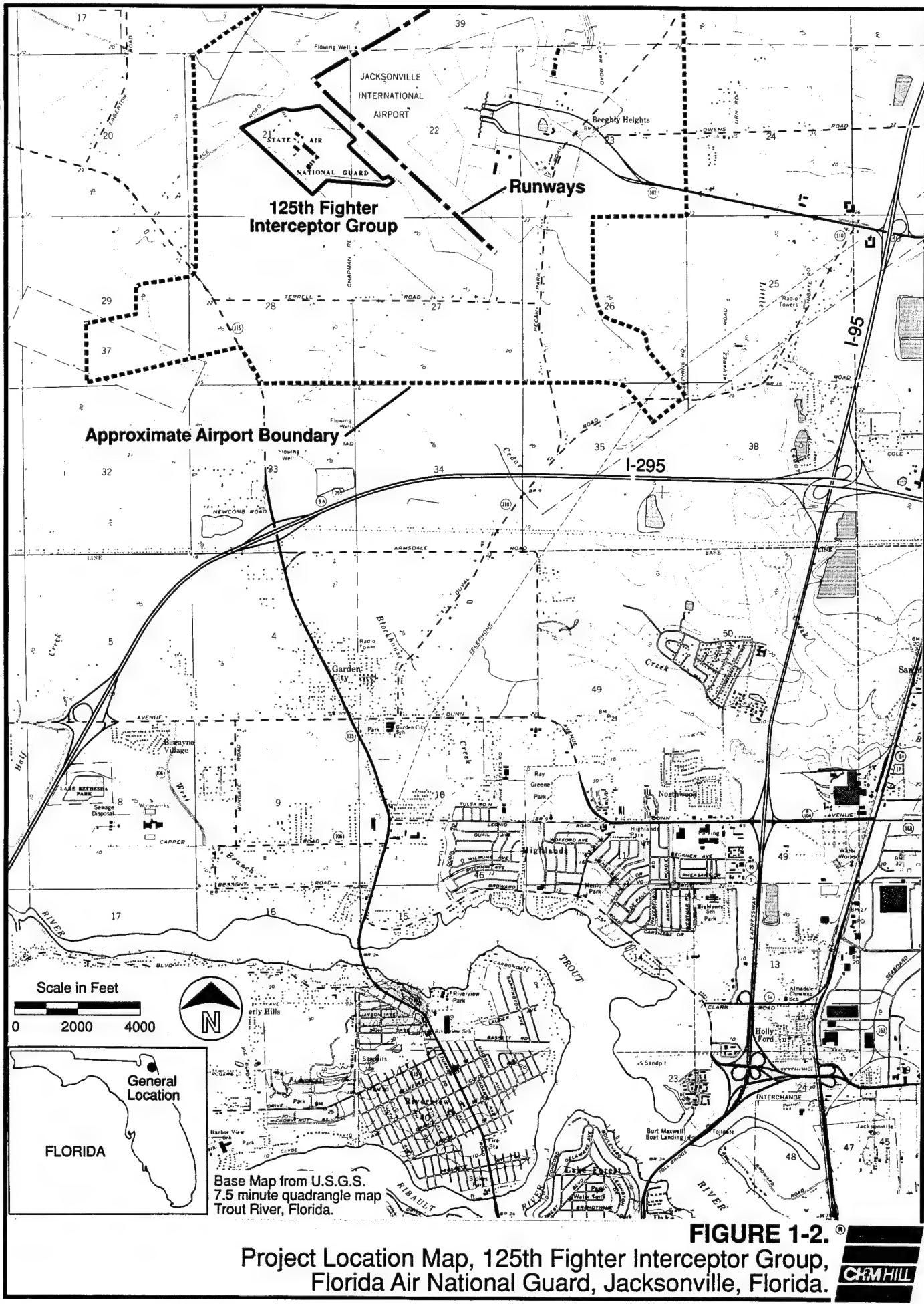
<u>General Criteria (FAC Ch. 17-3.061)</u>	<u>MCL</u>
Arsenic	0.05 mg/l
Chromium	0.05 mg/l
Lead	0.05 mg/l
Phenolic Compounds	1.00 µg/l

<u>Class III Criteria (FAC Ch. 17-3.121)</u>	<u>MCL</u>
Cadmium	0.0008 - 0.0012 mg/l <sup>a</sup>
Mercury	0.0002 mg/l
Selenium	0.025 mg/l
Silver	0.00007 mg/l
Polychlorinated Biphenyls	0.000001 mg/l
Phthalate Esters	0.003 mg/l
Lead	0.03 mg/l

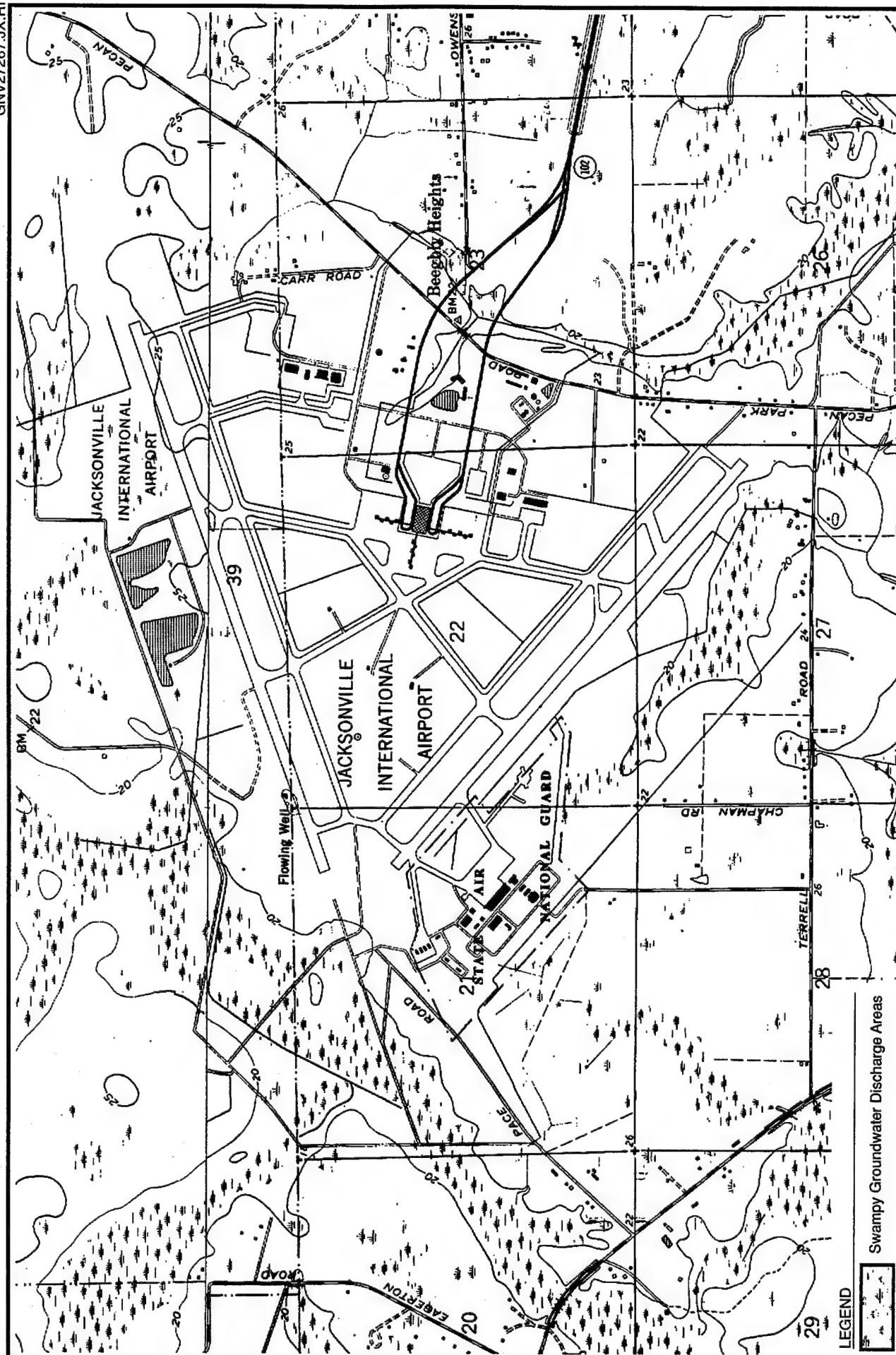
<sup>a</sup>Criterion is 0.0008 mg/l for predominantly fresh waters with a hardness of less than 150 and 0.0012 mg/l in harder waters.





**FIGURE 1-2.®**  
Project Location Map, 125th Fighter Interceptor Group,  
Florida Air National Guard, Jacksonville, Florida.





**FIGURE 1-3.®**  
Topographic Detail of the Project Area,  
125th Fighter Interceptor Group, Florida Air National Guard, Jacksonville, Florida.



Scale in Feet  
0 1000 2000

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**SECTION 2**  
*Field Activities*

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## **2. FIELD ACTIVITIES**

The primary objectives of the SI were to determine whether past site activities have resulted in significant contamination of soil, groundwater, surface water, and sediments; to assess the potential impacts of the contamination on human health and the environment; and to recommend the course of further IRP activities. A two-step approach, in which the results of initial field work were used to direct subsequent efforts toward sites most likely to require remediation, was implemented to meet the objectives. With the review and approval of NGB, HAZWRAP, and FDER, this approach has provided the flexibility to adjust the SI based on observed field conditions. The approach has also allowed timely handling of individual sites through the IRP process.

The activities performed during the two steps of the SI are described in detail in the following subsections. A summary of all SI field activities is shown in Table 2-1.

### **2.1 FIRST STEP OF THE SITE INVESTIGATION**

The primary objective of the field work performed as part of the first step of the SI was to assess whether past site activities have resulted in contamination of soil, groundwater, surface water, and/or sediments. Major field tasks included temporary well point installation, water level measurements, soil organic vapor headspace analyses, cone penetrometer testing, and sampling of groundwater, soils, and drainageway surface water and sediments.

#### **2.1.1 Temporary Well Point Installation**

A construction diagram for a typical temporary well point is presented in Figure 2-1. As described in the *Site Investigation Sampling and Analysis Plan*<sup>2</sup>, the main purposes for installing temporary well points were to assess the presence and extent of floating hydrocarbon contamination in shallow groundwater and to evaluate the extent of dissolved groundwater contamination. The total number of well points needed, therefore, would depend primarily on the amount of floating

hydrocarbons found, and it was initially anticipated that up to 80 well points could be installed to adequately assess the eight sites. However, no floating hydrocarbons were detected in the initial well points installed at any of the sites, so fewer were needed to satisfy the purposes of the investigation. In total, 52 temporary well points were installed at the eight sites at FANG, as shown on the large map provided as Attachment 1. The total includes the 51 well points originally installed and a replacement well point at a site that experienced flooding from surface drainage.

Most of the soils encountered at the sites during well point installation were fine grained, dense silty to clayey sands. While the soils were relatively easy to penetrate with the hand auger used for installation of the polyvinyl chloride (PVC) well points, field personnel suspected that the procedure intended for Site 2, the aircraft parking apron, might be difficult. A test attempt at Site 8 to implement the procedure, which at Site 2 would involve driving smaller diameter stainless steel (SST) well points into the soils underlying the parking apron, confirmed the difficulty. In addition, with the compacted soil under the parking apron, it was felt that the smaller diameter SST well points would not allow a sufficient quantity of recharge for all samples to be collected in 1 day.

Because the well points in the parking apron had to be installed, sampled, and removed as quickly as possible, a decision was made to use the PVC well points instead of the SST equipment. To facilitate installation, 4-inch diameter holes were cored through the aircraft parking apron so that the 3-inch diameter hand auger could be used. The 2-inch diameter PVC well points were then installed at five locations in the parking apron. The 1.5-inch diameter SST well points were installed at six locations around the edge of the parking apron. Soil cuttings from all boreholes in the apron at Site 2 were collected in a wheelbarrow and transported away from the apron. The area surrounding the borehole was then swept clean of remaining debris.

### **2.1.2 Cone Penetrometer Testing**

On May 30, 1989, In-Situ Technology, Inc., a specialty subcontractor, performed one piezocone penetration near well point (WP) 1-2 at Site 1 to obtain data on

the generalized geologic subsurface conditions at FANG. One hydrocone test was also performed to estimate the hydraulic properties of the surficial aquifer material. The piezocone methodology is described in detail in the *Site Investigation Sampling and Analysis Plan*<sup>2</sup> but can be simply explained as indicating soil density through point stress and soil cohesiveness through friction. Clayey soils tend to display higher friction and lower point stress, while sandy soils are indicated by higher point stress and lower friction. Pore pressure readings indicate the depth below the water table and possible zones of confined groundwater.

The piezocone was pushed until a dense zone was encountered at a depth of 90 feet bls. The hydrocone test was performed next to the piezocone penetration to determine local aquifer characteristics at 7 feet bls (3 feet below the water table). Section 3.1 discusses the results of the cone penetrometer testing.

### **2.1.3 Groundwater Sampling**

Because there were fewer well points and no apparent floating hydrocarbons, a decision was made to obtain groundwater samples from all of the well points. On June 2, 1989, several well points were purged by bailing to evaluate the time required for sufficient recharge for sampling. The well points were found to bail dry after yielding less than 2 gallons of water, and they recharged so slowly that they could not be sampled on the same day they were purged. Therefore, all well points were purged in 1 day and allowed to recharge for 2 days before sampling. Despite this plan, some well points had to be sampled two to three times to obtain a sufficient volume for all the analyses desired. In such cases, samples were collected the first day for volatiles, the second day for metals, and the third day for semivolatiles.

At Site 2, groundwater samples were obtained only from selected well points and only for volatile organics and lead analyses. This restricted coverage was necessary because of the difficulty in obtaining sufficient sample volumes and the limited time available for field work on the aircraft parking apron. The well points installed through the apron were removed after 2 days and the holes patched. The SST well points on the perimeter of the apron were slow to recharge and produced very silty water.

Heavy rainstorms during the sampling period caused surface flooding in several areas at FANG. Surface water filled some well points in those areas, because the annular space between the casing and the borehole of a well point is not sealed with grout (as for a permanent monitor well). Well points WP 1-1, 3W-5, 7-2, and 7-5 were flooded before any samples could be obtained. WP 3E-7, 5-1, and 5-2 were flooded after samples were obtained for volatiles analysis but before other parameters were sampled.

Soil headspace data and field observations indicated that contamination was likely at WP 1-1, so WP 1-1A was installed to obtain confirming groundwater samples. For Sites 3W and 7, the coverage provided by the remaining well points and the information obtained from headspace analysis and visual observations were felt to be sufficient for the purposes of this part of the SI. Because samples for analysis of volatiles, which are the selected indicators for contamination, had been obtained prior to the flooding of other well points, the lack of samples for other parameters was not considered significant.

#### **2.1.4 Soil Sampling**

##### **Organic Vapor Analyses**

Soils removed from all the boreholes during well point installation were screened for hydrocarbon contamination through identification of visible staining or the presence of fuel odors. The observations and estimated depth to the water table were the basis for selecting at least one soil sample from most of the boreholes for headspace analysis with an OVA; in total, 54 soil samples were analyzed with the OVA. Per FAC Chapter 17-70, each soil sample was collected by half filling a 16-ounce jar, which was covered with aluminum foil and brought to a constant temperature in a water bath. An OVA with an FID was used to measure the concentration of total organic vapors in the headspace above the soils in each jar.

##### **Laboratory Analyses**

The results of the OVA readings and field observations during well point installation were considered in selecting the locations and depths for collecting soil

samples for laboratory analyses. The 21 sample locations are shown in Attachment 1; 27 samples in total were collected, as samples were taken at different depths at some locations and three duplicate samples were collected. The samples were collected with a hand auger from boreholes made within 2 feet of the associated well point.

Soil samples for volatile organics analysis were collected from all well point locations where OVA readings exceeded 500 ppm, except at Site 2. Because all well points within Site 2 were either within or directly adjacent to the concrete parking apron, where soil excavation is not considered feasible, soil contamination was not felt to be an issue.

### **2.1.5 Drainageway Sampling**

For each of the four drainageway reaches at FANG, sediment samples were obtained from three locations and surface water samples from one location, as shown in Attachment 1. All drainageway samples were obtained after an extended period of dry weather (prior to any of the rainfall that occurred during the field work). As a result, analyses would not be affected by rainfall dilution and should reflect the highest concentrations of contaminants likely to be present. Drainageway sampling was performed before well point sampling.

Additional sediment samples (1 C.O. and 1 M.O.) were obtained from two locations in a small drainage ditch connected to the OWS inlet at the north end of the aircraft parking apron in the vicinity of WP 1-5 (see Attachment 1, location OWS-1). The samples were taken to investigate the possibility that surface drainage had been bypassing the OWS inlet and discharging directly into Reach 3 through this drainage ditch. Because the ditch was dry, only sediment samples could be obtained.

One sediment and one water sample were also obtained from the Site 4 OWS outfall (denoted as OWS-4 on Attachment 1), as it appeared from field observations that fuel contaminants had been discharged into this area.

## **2.2 SECOND STEP OF THE SITE INVESTIGATION**

The results of the first step of the SI, the preliminary hydrogeologic assessment, and the preliminary risk assessment indicated that field work should be performed during the second step of the SI to further evaluate the magnitude and extent of contamination identified at Sites 1, 3E, 5, 6, and 8. Sites 2, 3W, 4, and 7 were also included in the additional work in response to comments provided by FDER on the SITM<sup>3</sup> (see Appendix A). Major field tasks in the second step included installation of additional temporary well points and permanent monitor wells; soil, groundwater, and drainageway sampling; aquifer testing; and abandonment of all well points used during the SI. The sampling locations (shown in Attachment 1) and parameters analyzed in the second step of the SI were based on the results of the first step.

### **2.2.1 Temporary Well Point Installation**

In response to comments from FDER on the results of the first step of the SI, five 2-inch diameter well points were installed to complete the initial contamination assessment at Sites 2, 3W, and 7 (see well points 3W-5A, 7-2A, 7-5A, 2-12, and 2-13 on Attachment 1). As in the first step, a decontaminated hand auger was used for the installation.

Lead concentrations exceeded standards in three well points at Site 2 in the first step of the SI but were believed to be a result of total lead concentrations associated with suspended solids present in the groundwater samples. Well points WP 2-12 and 2-13 were installed on the east and west sides of the aircraft parking apron so that field-filtered and unfiltered groundwater samples could be obtained for lead analysis, as requested by FDER.

As described in Section 2.1.3, WP 3W-5, 7-2, and 7-5 were flooded with surface runoff before groundwater samples could be obtained in the first step of the SI. At the request of FDER, well points WP 3W-5A, 7-2A, and 7-5A were installed within 2 feet of the flooded locations during the second step to allow collection of groundwater samples for volatiles, semivolatiles, and lead analyses.

Additional well points were installed at Site 6 to evaluate the extent of chromium contamination detected in the groundwater samples from the monitor wells installed at the site for the second step of the SI. Well points WP 6-4, 6-5, and 6-6 were installed downgradient of the two monitor wells in accordance with procedures used previously for the SI.

One additional well point was installed at Site 7 to evaluate whether groundwater at Site 7 was contributing to the chromium detected in the drainageway near this site. Well point WP 7-8 was installed approximately 2 feet northwest of where WP 7-7 was located in accordance with procedures used previously for the SI. Both a filtered and unfiltered sample were collected from WP 7-8 and analyzed for chromium.

### **2.2.2 Well Point Sampling**

When the five new well points at Sites 2, 3W, and 7 were purged dry on November 30, 1989, the water was very turbid and silty, similar to the conditions found in the well points during the first step of the SI. Samples from all five well points were obtained on December 1, 1989, and filtered and unfiltered samples for lead analysis were obtained from WP 2-12 and 2-13 on December 4, 1989. The unfiltered samples were collected first with a decontaminated teflon bailer, then a peristaltic pump and an inline 0.45-micron synthetic fiber filter were used to collect the filtered sample, per FDER QAS Guidance 89-05, Field Filtration Apparatus (revised on September 19, 1989).

The chromium detected in Site 6 groundwater was suspected of being related to suspended sediments in the samples. To evaluate this possibility, the three additional well points installed at the site were purged with a decontaminated teflon bailer and then sampled using a peristaltic pump to collect unfiltered and filtered samples for total chromium analysis. Sampling was conducted on November 5, 1990, in accordance with FDER QAS Guidance 89-05, Field Filtration Apparatus (revised on September 19, 1989).

### **2.2.3 Well Point Abandonment**

After groundwater samples were obtained from the new well points, all of the well points that had been installed as part of the SI were removed. The PVC well points were pulled out of the ground and disposed of and the SST well points were removed and retained for future use. The holes were filled with soil cuttings removed during well point installation. The uppermost 1 to 2 feet of the holes were filled with commercial bentonite clay pellets and hydrated to provide a seal to prevent surface water infiltration into the disturbed soil.

### **2.2.4 Monitor Well Installation**

The original scope of work for the SI had included 27 monitor wells to be distributed among the eight sites at FANG. However, because the results of the first step of the SI indicated less extensive contamination than had been anticipated, only 11 monitor wells were constructed: two at Site 1, two at Site 3E, two at Site 5, two at Site 6, and three at Site 8 (as shown in Attachment 1).

The wells were drilled with hollow-stem augers to a depth of 15 feet bls and were constructed inside the augers using 2-inch diameter PVC casing and 0.010-inch slot screen. As shown in Figure 2-2, the PVC casing in each well extends from land surface to 5 feet bls and the screened interval is from 5 to 15 feet bls. The extent of the screened interval was selected to allow for floating hydrocarbon measurements and provide samples representative of groundwater in the surficial aquifer. Monitor wells were installed in accordance with procedures in the *Site Investigation Sampling and Analysis Plan*.<sup>2</sup> At present, there are no plans for monitor well abandonment.

The soil cuttings from the hollow-stem augers were logged as the drilling proceeded. Soil boring logs for the wells are provided in Appendix B. The soils encountered during the monitor well drilling were consistent with conditions noted during well point installation for the first step of the SI. The soil cuttings from the boreholes were spread on the ground in the vicinity of the monitor wells as directed by FANG personnel.

### **2.2.5 Monitor Well Sampling**

On December 1, 4, and 5, 1989, groundwater samples were obtained from the 11 monitor wells installed as part of the second step of the SI and from 3 wells installed by others as part of an underground storage tank (UST) investigation in the Vehicle Maintenance Compound near Site 5. The three wells installed by others were reportedly completed to 10 feet bbls and screened from 3 to 10 feet bbls. The screened interval is similar enough to that of the SI monitor wells that groundwater samples will be representative of the same zone.

On November 5, 1990, a second set of groundwater samples was obtained from the two monitor wells at Site 6 for total chromium analysis. Both filtered and unfiltered samples were collected with a peristaltic pump, per FDER QAS Guidance 89-05, Field Filtration Apparatus (revised on September 19, 1989).

Before samples were taken, water elevations in the monitor wells were measured with a decontaminated electronic oil/water interface probe. No floating hydrocarbons were detected in any of the wells. The well casing volumes were calculated, and a decontaminated teflon bailer was used to purge the wells of at least four casing volumes. pH, temperature, and conductivity were monitored during purging, which continued until consecutive measurements were within 15 percent of each other.

### **2.2.6 Soil Sampling**

#### **Organic Vapor Analyses**

OVA readings above 500 ppm were noted in 15 of the 54 soil samples collected from hand-augered borings during the first step of the SI. To investigate the possibility that sources other than petroleum hydrocarbons were responsible for the high readings, OVA readings were taken in the second step with an instrument equipped with a carbon filter to differentiate between methane and other organic vapors. Samples were collected at three well points (WP 1-2, 2-7, and 4-2) considered representative of those with the high readings. Each sample was taken with a decontaminated SST hand auger and split into two portions. One portion

was analyzed with a carbon filter on the OVA to detect methane and the other without the filter to detect total volatile organic vapors. The results, discussed in Section 5.2.1, indicated methane as the dominant organic vapor in the soil.

### **Laboratory Analyses**

To obtain representative background analyses for comparison with soil samples collected throughout the SI, a soil sample was obtained from a location isolated from the eight sites and not associated with known activities at FANG (see Attachment 1 for location). The sample was obtained with a decontaminated SST hand auger according to the procedure used in the first step of the SI and described in the *Site Investigation Sampling and Analysis Plan*<sup>2</sup>. The sample was sent to the laboratory for analysis for volatiles, semivolatiles, and priority pollutant metals.

The results of soil sampling during the first step of the SI indicated higher concentrations of barium, chromium, and lead at Site 8 than at the other sites. Additional soil samples were taken at Site 8 during the second step of the SI for analysis for these constituents. The samples were obtained during standard penetration tests (SPTs) conducted in the boreholes for monitor wells (MW) 8-1, 8-2, and 8-3. Sampling depths were above the water table (1 to 3 feet bls) and just at the water table (3 to 5 feet bls) to assess the potential for soil contamination that could act as a source of groundwater contamination. A sample was also collected from a soil boring (SB 8-5) that was drilled for standard penetration testing (see Attachment 1 for location). The soil samples were collected with SST sampling spoons from the center of a decontaminated 2-foot SPT split-barrel sampler (split-spoon) that had been driven through the soil at the appropriate depths. The SPTs were conducted according to ASTM Standard D1586, and the results are included on the boring logs in Appendix B.

#### **2.2.7 Drainageway Sampling**

Sediment samples were collected on November 28, 1989, at the locations shown in Attachment 1. To provide representative background concentrations of chemical parameters for comparison to results from the other samples taken during the SI,

a sediment sample was collected from a location on the FANG drainageway system isolated from and upstream of the eight sites and not associated with known activities at FANG. Surface water samples were collected at two points downstream of the locations sampled during the first step of the SI: DG-1 at the confluence of Reaches 1 and 2 and DG-2 at a point approximately 1,000 feet downstream of DG-1 and immediately upstream of a drainage inflow structure originating at Jacksonville International Airport (see Attachment 1 for locations). Surface water samples were collected from these two locations on December 1, 1989.

### **2.2.8 Aquifer Testing**

On January 3, 1990, slug tests were performed on monitor wells MW 1-1, 3E-2, 5-2, 6-1, and 8-1. All equipment was decontaminated before and between usage at each well. The results of the slug tests are discussed in Section 3.3.

The slug tests were conducted by inducing an instantaneous change in the water level in the well and monitoring the associated water level response with an electronic data recording system. After the initial (static) water level was measured with a steel tape, a pressure transducer was placed below the water level in the well and connected by an electronic transmission cable to a data logger. The slug (a PVC cylinder weighted with gravel) was then inserted into the well (slug-in portion) to induce an essentially instantaneous rise in the water level. After the rate at which the water returned to its static level was recorded by the data logger, the slug was quickly removed from the well (slug-out portion) to induce a corresponding instantaneous drop in the water level. The subsequent rise to the original static water level was also recorded by the data logger.

In well MW 8-1, the slug-in portion of this test could not be conducted properly because the water overflowed the top of the casing in the well as the slug was inserted. The same problem was encountered in the other monitor wells at Site 8. As a result, the procedure for the test was altered at this site as follows: (1) the water was allowed to overtop the well casing on insertion of the slug, (2) the water was removed from the well vault, (3) the water in the well was allowed to return

to its static level, and (4) the slug was removed and the water level response recorded.

### **2.3 INVESTIGATION-DERIVED WASTE MANAGEMENT**

Procedures described in the *Site Investigation Sampling and Analysis Plan*<sup>2</sup> for handling investigation-derived waste assumed much higher contaminant concentrations in soil and groundwater than were detected at any of the sites during the first step of the SI. As a result, the original waste management procedures were considered inappropriate for the second step of the SI, and an alternate procedure was followed in which soil cuttings from monitor well installation were spread on the ground at locations on FANG designated by the Deputy Base Civil Engineer. In addition, water extracted from each monitor well during development and purging was discharged on the ground near the well.

### **2.4 DEVIATIONS FROM SITE INVESTIGATION SAMPLING AND ANALYSIS PLAN**

The original procedure proposed for installing temporary well points in the concrete aircraft parking apron at Site 2 during the first step of the SI was to drive them into the soil. After field work revealed that site soils were very cohesive and fine grained, however, it was determined that hand-augered borings would be more appropriate for these well points. Soil cuttings were collected and removed from the apron.

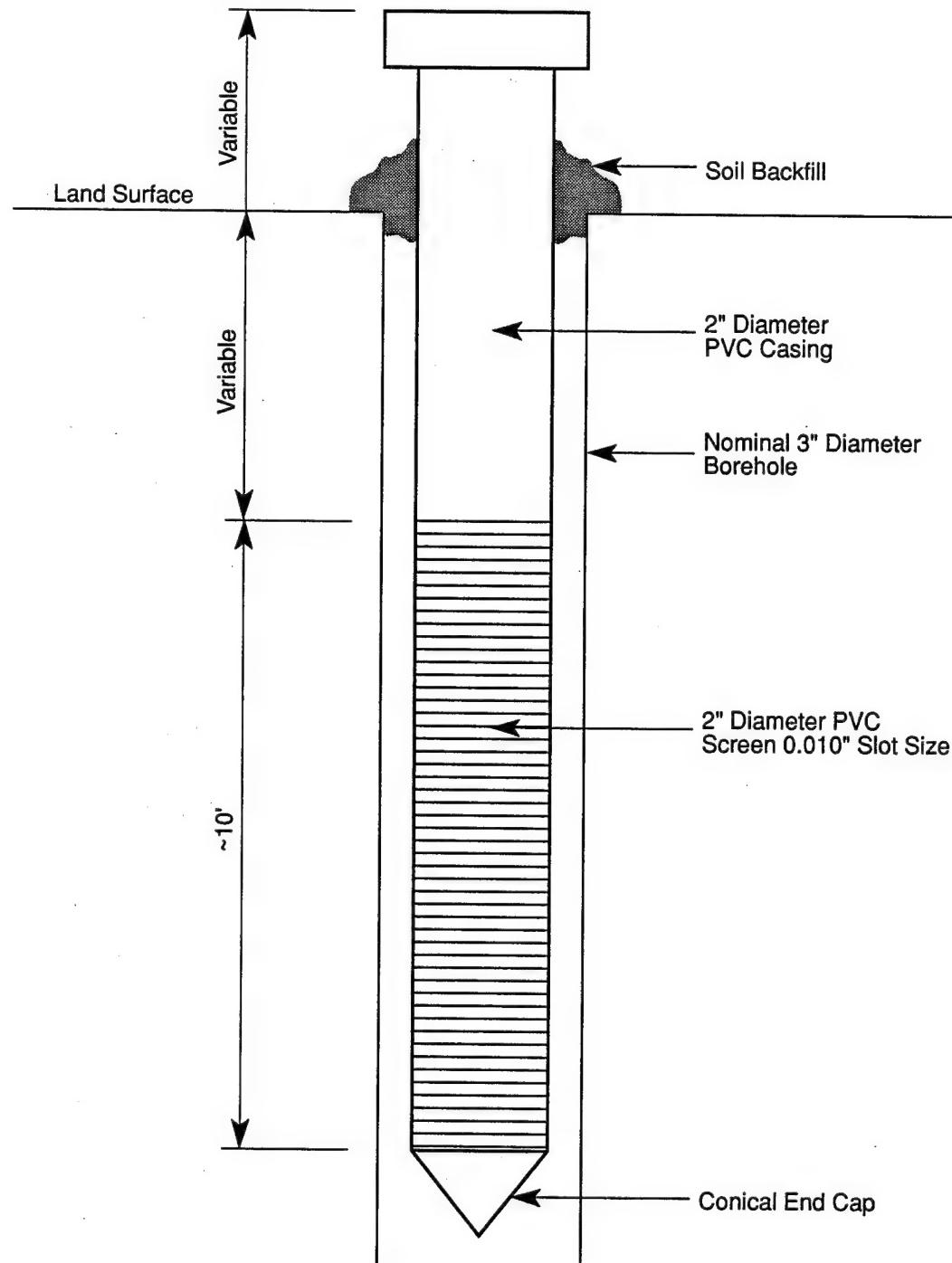
During the first step of the SI, two sediment samples not proposed in the *Site Investigation Sampling and Analysis Plan*,<sup>2</sup> 1 C.O. and 1 M.O., were collected in an overflow drainage feature leading from the westernmost OWS inlet at Site 1 to Reach 3. The drainage feature was dry at the time. The samples were collected for laboratory analyses to assess the potential for contaminant transport from the OWS inlet area to Reach 3.

As described in Section 2.3, an alternate procedure was developed for handling investigation-derived waste during the second step of the SI. Other deviations from the *Site Investigation Sampling and Analysis Plan*<sup>2</sup> included the methane

differentiation OVA screening performed on three soil samples (described in Section 2.2.6) and the installation and sampling (including field-filtered samples) of several additional well points at the request of FDER, as described in Sections 2.2.1 and 2.2.2. FDER requested the additional well points to complete initial screening activities at sites where surface water flooding had inhibited or prevented sampling during the first step of the SI. Collection and analysis of field-filtered samples was requested as a means for differentiating results for total and dissolved lead.

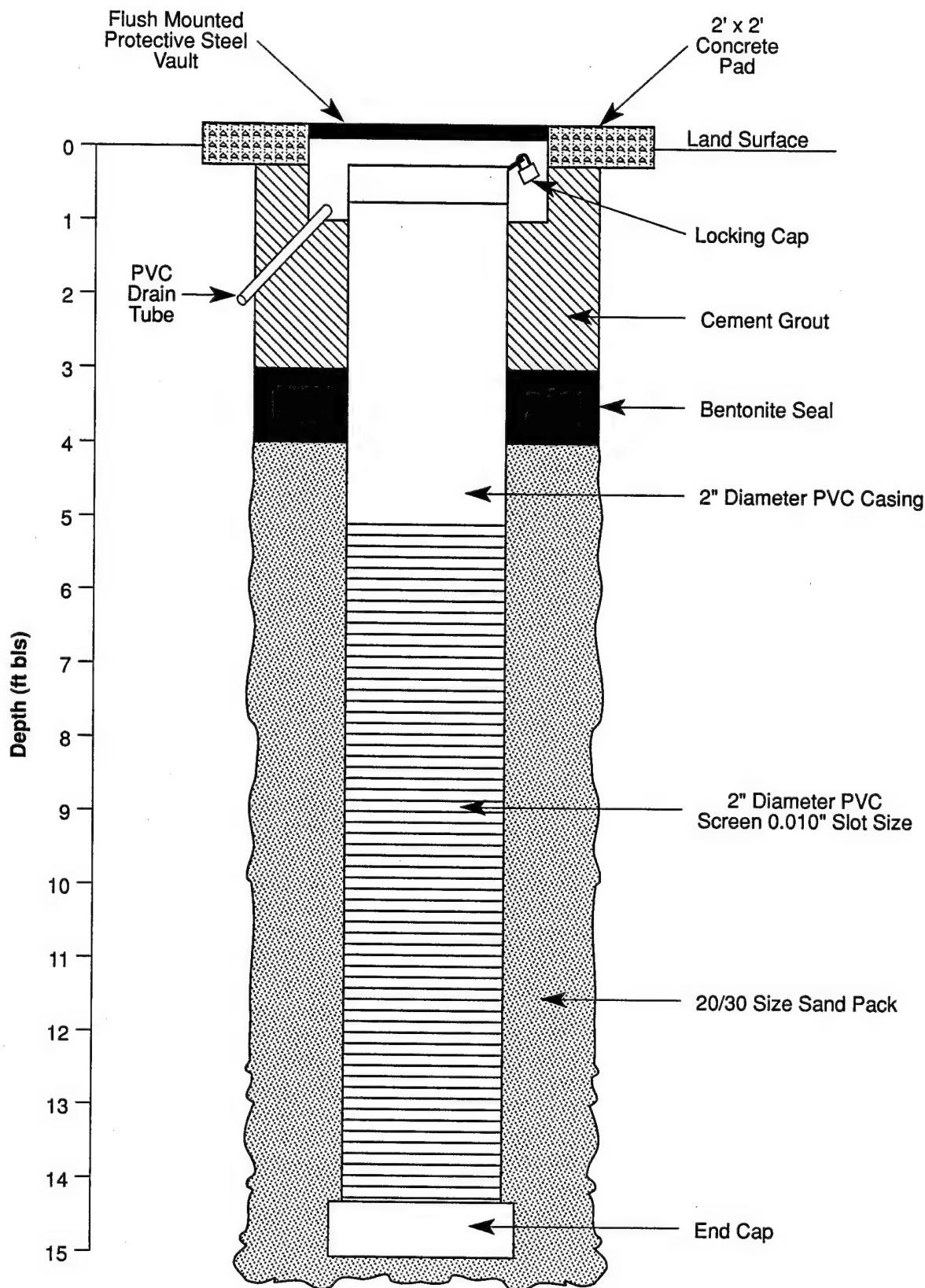
**Table 2.1**  
**SUMMARY OF FIELD ACTIVITIES AND SAMPLES COLLECTED FOR THE SITE INVESTIGATION**

Site	Step 1						Step 2					
	Well Points	OVA Soil	Lab Soil	Ground-water	Surface Water	Sediment	Well Points	Monitor Wells	OVA Soil	Lab Soil	Ground-water	Surface Water
1	7	6	11	20	-	6	0	2	1	0	4	-
2	12	16	0	8	-	-	2	0	1	0	6	-
3E	9	7	10	29	-	-	0	2	0	0	4	-
3W	5	5	4	12	-	-	1	0	0	0	2	-
4	3	3	12	12	3	3	0	0	1	0	0	-
5	3	3	9	5	-	-	0	2	0	0	5	-
6	3	3	4	6	-	-	6	7	0	0	13	-
7	7	7	4	15	-	-	3	0	0	0	5	-
8	4	4	9	15	-	-	0	3	0	9	4	-
Reach 1	-	0	0	-	3	9	-	-	-	-	0	0
Reach 2	-	0	0	-	3	9	-	-	-	-	0	0
Reach 3	-	0	0	-	3	9	-	-	-	-	0	0
Reach 4	-	0	0	-	6	14	-	-	-	-	0	0
Downstream Location 1	-	0	0	-	0	0	-	-	-	-	1	1
Downstream Location 2	-	-	-	-	0	0	-	-	-	-	1	1



**FIGURE 2-1.**  
Temporary Well Point Construction Diagram, ©  
125th Fighter Interceptor Group,  
Florida Air National Guard, Jacksonville, Florida





**FIGURE 2-2.**  
Monitor Well Construction Diagram, ©  
125th Fighter Interceptor Group,  
Florida Air National Guard, Jacksonville, Florida.



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**SECTION 3**  
*Hydrogeologic Assessment*

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### 3. HYDROGEOLOGIC ASSESSMENT

#### 3.1 LOCAL LITHOLOGY

The following discussion on the geologic profile of Duval County is summarized from Florida Geological Survey Report of Investigations No. 43 (Leve, 1966)<sup>5</sup>:

In descending order, the geologic profile includes the Pleistocene and Recent sedimentary deposits, Upper Miocene to Pliocene sediments, the Hawthorn Formation, the Ocala Group Limestones, the Avon Park Limestone, the Lake City Limestone, and the Oldsmar Limestone. The Pleistocene and Recent sediments consist of fine to medium poorly sorted sand and clayey sand with yellow or orange iron staining and range from 20 to 150 feet thick. The Upper Miocene and Pliocene deposits, which range in thickness from 20 to 100 feet, consist of interbedded gray-green calcareous silty clay and clayey sand, fine to medium sand, and cream to brown soft friable limestone. A phosphatic sand and gravel bed marks the contact between these deposits and the Hawthorn Formation, which has a similar lithology but includes significant quantities of phosphate. The Hawthorn Formation ranges in thickness in Duval County from 250 to 500 feet.

The principal aquifer system in the area is the Floridan, which is found within the Ocala Group, Avon Park, Lake City, and Oldsmar limestones. The Hawthorn Formation acts as an upper confining unit for the Floridan aquifer, restricting flow between it and the surficial aquifer.

Leve<sup>5</sup> reports that the shallow aquifers overlying the Floridan limestone aquifer consist of sand and shell beds within the Pleistocene and Recent deposits; shell, limestone, and sand beds within the Upper Miocene and Pliocene deposits; and limestone and sand beds within the Hawthorn Formation. Fairchild<sup>6</sup> states that hardpan layers of iron-oxide cemented quartz sand may be present within the Pleistocene and Recent deposits and that the potentiometric surface of the Floridan aquifer may be higher than the surficial aquifer, providing it with upward

recharge. This opinion is substantiated by the presence of artesian wells in the area.

The cone penetrometer testing performed by In-Situ Technology, Inc., provided additional data on the hydrogeology in the western portion of FANG. The results of the piezocone penetration (provided in Appendix C) indicate that the geologic profile consists mainly of weakly consolidated to unconsolidated, fine grained sediments to a depth of 90 feet. The sedimentary material ranges from fine sand to soft clay and muck. The test was terminated at 90 feet bls, where a dense layer prevented further penetration of the piezocone. A generalized geologic section based on the piezocone results is shown in Figure 3-1.

The piezocone sounding test in Appendix C appears to indicate clayey strata occurring at about 4 to 6 feet, 24 to 26 feet, and around 60 feet bls. The pore pressure shows a marked increase from about 67 to 77 feet, which may indicate a primary zone of semi-confined groundwater. Pore pressure data also suggest the presence of other semi-confined zones throughout the profile.

Four soil types have been mapped in the FANG area by the Soil Conservation Service<sup>7</sup> (see Figure 3-2). The Pelham fine sand, a nearly level, poorly drained soil found in broad flatwood areas, is rapidly permeable to a depth of 21 inches and moderately permeable below. The Arents soils, which are nearly level and poorly drained, have been reworked by earthmoving operations and generally consist of mixed native and imported materials. The Yulee clay is a nearly level, very poorly drained soil with moderately slow permeability. Urban land soils consist of areas with 85 percent or higher coverage by buildings, pavement, or other development.

Soil profiles were noted for the boreholes made during well point installation. In general, the soil profile over most of the sites consists of dark gray sand and organic matter overlying dark brown to orange clayey silty sand overlying gray to blue clayey sandy silt. Most of the soils are dense and fine grained, which indicates limited permeability. Rainfall was observed to mainly pond and run off; the lack of percolation also suggests low permeability soils. In many of the soils,

yellow or orange iron-oxide stains indicate an oxidizing environment, and several boreholes contained organic muck, roots, and wood chips.

The boreholes drilled for monitor wells installed as part of the second step of the SI were logged by noting the lithology of the soil cuttings brought to the surface by the hollow-stem augers. Soil boring logs are provided in Appendix B. The soil borings substantiate the data obtained from the hand-augered borings performed in the first step of the SI that indicate two distinct lithologies at FANG.

At Sites 1, 2, 3E, 3W, 4, 7, and 8, the sediments were finer grained with a higher clay and silt content than was exhibited at Sites 5 and 6. Brown or dark gray to blue-gray silty to clayey sand was encountered in the boreholes for the wells at Sites 1, 3E, and 8; these soils demonstrated high plasticity and cohesiveness, as they wound around the auger blade as it was brought to the surface. The sediments at Sites 5 and 6 were generally coarser and less cohesive than those at the other sites and would be expected to be more permeable.

### **3.2 WATER ELEVATION DATA AND GROUNDWATER FLOW DIRECTIONS**

#### **3.2.1. First Step of the Site Investigation**

Table 3-1 lists groundwater elevations measured on June 2, 1989, in all the well points except those for Site 2, which had not yet been installed. Water levels measured in the three monitor wells installed by others near Site 5 are also included. The data reflect conditions after a long dry period (none of the rain events experienced during the field work had yet occurred), and the measurements were made before any water was evacuated from any of the well points. The dry conditions are also reflected in the surface water elevation data in Table 3-2, which were obtained when the drainageway reach sampling locations were surveyed on June 1 and 2, 1989.

Groundwater elevations in the same well points shown in Table 3-1 were measured again on June 23, 1989, after several rainfall events, and the data are reported in Table 3-3. The elevations were generally higher by about 1 foot at most of the sites, but showed little change at Sites 3E and 3W. Table 3-3 also lists

elevation data for measurements made on June 23 at several well points at Site 2, as well as groundwater elevations measured on June 13, 1989, in WP 2-1 through 2-5 on the aircraft parking apron. These well points were removed on June 14, 1989.

Figure 3-3 shows groundwater contours based on well point data collected in June 1989. The data indicate a general flow of groundwater from west to east. While some local effects are shown in Figure 3-3, groundwater flow directions on a local (individual site) scale may vary. Groundwater flow at individual sites is addressed below.

Figure 3-4 shows the elevations of groundwater in well points at Sites 1 and 2 and of surface water at the sampling locations in nearby Reach 3. At Site 1, shallow groundwater appears to be flowing in a northeasterly direction toward the drainageway. At Site 2, the groundwater elevations are higher beneath the aircraft parking apron than in the well points adjacent to the apron, so groundwater appears to be flowing from the apron in all directions.

The shallow groundwater elevations in the well points at Site 3E and the surface water elevations at sampling points R2D, R1C, and R1D are shown in Figure 3-5. Groundwater flow at this site is variable and may be affected by topography, surface drainage patterns, and the two drainageway reaches that border the site to the northeast and south. Shallow groundwater flow appears to be toward Reach 2 in the northern part of Site 3E and toward Reach 1 in the southern part of the site. The groundwater elevation in WP 3E-2 is anomalously low and the elevation at R1C appears to be high. The irregularities in water levels may be attributable to the presence or absence of lenses of groundwater that are perched on top of clayey soils.

Figure 3-6 shows the shallow groundwater elevations in well points at Sites 3W and 7 and surface water elevations at sampling point R2C in Reach 2. The shallow groundwater flow at Site 3W appears to follow the surface drainage patterns determined by topography. In general, groundwater flows from the higher area near WP 3W-1 toward the lower area near WP 3W-4. At Site 7, the general direction of shallow groundwater flow appears to be toward Reach 2. In

the immediate vicinity of the trim pad, however, the groundwater flow pattern is unclear and is probably affected by local recharge conditions around the trim pad, differences in evaporation rates, soil compaction from construction, and local topography.

Site 4 shallow groundwater elevations and surface water elevations at R3D and R2U are shown in Figure 3-7. The data indicate a northeast-to-southwest groundwater flow direction, from the Hush House toward a nearby swampy wooded area. Surface soils in this wooded area were essentially dry at the beginning of field activities but would be expected to be saturated by a rise in shallow groundwater during wet seasons. Pools of standing water were observed in this area after several rainfall events during the SI.

Figure 3-8 shows the shallow groundwater elevations in well points at Site 5 and the three monitor wells installed by others in the Vehicle Maintenance Compound. The water table at this site is relatively flat, but movement appears to be toward the drainage ditch to the immediate southwest.

The shallow groundwater elevations at Site 6 are shown in Figure 3-9 and indicate a relatively flat water table. Groundwater appears to flow in a northwesterly direction, following the general land surface topography.

Figure 3-10 shows the shallow groundwater elevations in the well points at Site 8 and the surface water elevations in Reach 4. The direction of groundwater flow appears to be north from the OWS toward the drainageway.

### **3.2.2. Second Step of the Site Investigation**

Table 3-4 lists the groundwater elevations measured between December 1 and 5, 1989, in the newly installed and existing monitor wells at the eight sites. Table 3-5 lists the groundwater elevations measured at Site 6 on November 5 and 20, 1990. The measurements were made in each well immediately before it was purged for sampling. A comparison of Tables 3-4 and 3-1 indicates that groundwater elevations at FANG were similar in June and December 1989.

Figure 3-11 shows groundwater contours based on monitor well data collected in December 1989. The data indicate a general flow of groundwater from west to east, as was previously observed in June 1989. Groundwater flow at individual sites is discussed below.

The shallow groundwater elevations in the monitor wells at Site 1 are shown in Figure 3-12. The water table is relatively flat and appears to flow in a northerly direction toward Reach 3, as observed in previous well point data.

Figure 3-13 shows the shallow groundwater elevations measured in the monitor wells at Site 3E. As in the first step of the SI, the general direction of groundwater flow in the southern portion of the site appears to be toward Reach 1.

The shallow groundwater elevations at Site 5 are shown in Figure 3-14. The water table is relatively flat, and the direction of groundwater flow appears to be toward the west and southwest.

Figure 3-15 shows the shallow groundwater elevations in the monitor wells at Site 6. The water table is relatively flat. The apparent gradient toward the west is consistent with the gradient observed in the first step of the SI.

Figure 3-16 shows the groundwater elevations in the monitor wells and three additional well points at Site 6 in November 1990. The groundwater flow direction appears to be to the northwest, as observed previously at the site.

The shallow groundwater elevations at Site 8 are presented in Figure 3-17 and indicate that the water table is relatively flat. In the southern portion of the site, groundwater appears to flow in a northeasterly direction toward Reach 4, which is probably a local groundwater divide (i.e., surficial groundwater flow does not cross Reach 4). Groundwater north of Reach 4 (in the vicinity of MW 8-3) is expected to flow to the southeast, toward (and possibly discharging into) the drainageway.

### **3.2.3 Groundwater-Surface Water Interaction**

Surface water elevations were shown in Figures 3-4 through 3-17 to help illustrate the relationships between shallow groundwater and drainageway surface waters, which are important in understanding flow patterns at FANG. The apparent inconsistency of the connection between surface water and groundwater elevations across FANG is a result of several factors. Inputs of water from outside sources (e.g., direct rainfall, upstream inflow, wash water from FANG activities) can raise surface water elevations above groundwater elevations, causing water to flow from the drainageways into the shallow groundwater (as well as downstream in the channels themselves). Conversely, when there is little outside inflow to the drainageways and conditions are dry, groundwater is generally higher than the surface water and flows into the drainageways.

## **3.3 ESTIMATED AQUIFER CHARACTERISTICS**

### **3.3.1 Cone Penetrometer Testing**

During the first step of the SI, a subconsultant, In-Situ Technology, Inc., performed a permeability test of shallow aquifer materials at a depth of 7 feet bsl. Detailed test data are presented in Appendix C. The test location is shown in Attachment 1. Based on test interpretations by the subconsultant, the hydraulic conductivity (K) of the material at that location and depth appears to range from about 1.5 to  $2.0 \times 10^{-4}$  cm/sec (0.43 to 0.57 ft/day). If a K value of about  $1.75 \times 10^{-4}$  cm/sec (0.5 ft/day) is assumed, along with an estimated range of porosity of 0.2 to 0.4 (based on literature values for comparable media) and a measured range of hydraulic gradients at FANG of 0.001 to 0.05 ft/ft, the average linear horizontal groundwater flow velocity is estimated to range from 0.00125 to 0.125 ft/day in the surficial aquifer in the area of the test.

### **3.3.2 Slug Testing**

Slug tests were performed at one well on each of the five sites where monitor wells were constructed during the second step of the SI. Data from each slug test were analyzed by a method described by Bouwer<sup>8</sup> to estimate the K of the upper

unconfined aquifer throughout the site. Because the geology of the aquifer material may not be uniform over the site, the actual K value at other locations may differ from the estimate. Tables of calculations for K values are provided in Appendix D, along with the slug test data and semi-log plots of water level versus time.

The representative K for each of the five sites at which slug tests were performed is shown in Table 3-6. The estimates were obtained by rounding the K values calculated using the slug test data to the nearest integer value. Hydraulic conductivity appears to be lower on the eastern side of FANG (Sites 1 and 3E) and higher on the western side (Sites 5, 6 and 8); the highest K value was estimated for Site 6, which is the westernmost site at FANG. The data are consistent with the observations of subsurface conditions encountered during hand-auger borings and monitor well drilling across FANG.

The K estimates from slug test results include the entire screened interval of the aquifer (5 to 15 feet bls). They are not, therefore, directly comparable to the K value of approximately 0.5 ft/day estimated by the piezocone testing, which was performed in the vicinity of MW 1-1 at a depth of 7 feet bls. The slug test data provide an average K over a greater interval than the data from the piezocone test; this average is probably more representative of the bulk flow of groundwater through the surficial aquifer.

**Table 3-1**  
**GROUNDWATER ELEVATION DATA FROM JUNE 2, 1989**  
**(FIRST STEP OF THE SI)**  
**125TH FIGHTER INTERCEPTOR GROUP,**  
**FLORIDA AIR NATIONAL GUARD, JACKSONVILLE, FLORIDA**

Location	Top of Casing Elevation (ft)	Depth to Water (ft)	Groundwater Elevation (ft)
WP 1-1	26.08	4.59	21.49
WP 1-2	27.00	6.67	20.33
WP 1-3	27.66	6.19	21.47
WP 1-4	27.00	5.89	21.11
WP 1-5	25.83	4.69	21.14
WP 1-6	25.69	4.94	20.75
WP 3E-1	22.37	5.03	17.34
WP 3E-2	23.34	6.65	16.69
WP 3E-3	24.29	7.00	17.29
WP 3E-4	21.44	4.27	17.17
WP 3E-5	23.24	5.55	17.69
WP 3E-6	25.29	5.48	19.81
WP 3E-7	24.31	5.98	18.33
WP 3E-8	24.51	5.43	19.08
WP 3E-9	25.76	7.64	18.12
WP 3W-1	22.95	4.81	18.14
WP 3W-2	22.72	5.33	17.39
WP 3W-3	21.31	3.92	17.39
WP 3W-4	21.78	5.71	16.07
WP 3W-5	22.26	4.91	17.35
WP 4-1	27.81	5.21	22.60
WP 4-2	22.85	3.47	22.38
WP 4-3	22.92	4.24	18.68
WP 5-1	25.11	3.14	21.97
WP 5-2	25.32	3.30	22.02
WP 5-3	28.01	5.99	22.02
WP 6-1	30.40	DRY	
WP 6-2	29.29	7.14	22.15
WP 6-3	28.69	6.41	22.28
WP 7-1	25.02	6.17	18.85
WP 7-2	25.31	6.27	19.04
WP 7-3	23.96	5.38	18.58
WP 7-4	25.71	7.17	18.54
WP 7-5	23.47	5.74	17.73
WP 7-6	23.75	5.80	17.95
WP 7-7	23.93	6.14	17.79
WP 8-1	25.29	3.69	21.60
WP 8-2	25.63	4.19	21.44
WP 8-3	26.07	4.51	21.56
WP 8-4	24.08	2.70	21.38
MW-A <sup>a</sup>	27.30	4.96	22.34
MW-B <sup>a</sup>	26.95	4.66	22.29
MW-C <sup>a</sup>	27.69	5.57	22.12

Note: All water level and top of casing survey measurements made by CH2M HILL. See Attachment 1 for locations.

<sup>a</sup>Monitor well installed by others.

**Table 3-2**  
**SURFACE WATER ELEVATIONS MEASURED**  
**AT DRAINAGEWAY SAMPLING LOCATIONS ON JUNE 1 AND 2, 1989**  
**(FIRST STEP OF THE SI)**  
**125TH FIGHTER INTERCEPTOR GROUP,**  
**FLORIDA AIR NATIONAL GUARD,**  
**JACKSONVILLE, FLORIDA**

<u>Location</u>	<u>Water Surface Elevation (ft)</u>
R1U	Not Measured
R1C	18.9
R1D	18.0
R2U	18.3
R2C	17.3
R2D	16.5
R3U	20.5
R3C	18.9
R3D	18.9
R4U	22.8
R4C	21.7
R4D	21.3

Note: All water level measurements surveyed by CH2M HILL. See Attachment 1 for locations.

**Table 3-3**  
**GROUNDWATER ELEVATION DATA FROM JUNE 13 AND 23, 1989**  
**(FIRST STEP OF THE SI)**  
**125TH FIGHTER INTERCEPTOR GROUP,**  
**FLORIDA AIR NATIONAL GUARD, JACKSONVILLE, FLORIDA**

Location	Top of Casing Elevation (ft)	Depth to Water (ft)	Groundwater Elevation (ft)	Comments
WP 1-1	26.08	2.69	23.39	
WP 1-1A	24.51	0.98	23.53	may contain surface water
WP 1-2	27.00	6.43	20.57	may contain surface water
WP 1-3	27.66	4.53	23.13	
WP 1-4	27.00	3.81	23.19	
WP 1-5	25.83	2.50	23.33	
WP 1-6	25.69	3.15	22.54	
WP 2-1	27.10	4.48	22.62	measured 6/13/89
WP 2-2	26.75	4.33	22.42	measured 6/13/89
WP 2-3	27.10	4.37	22.73	measured 6/13/89
WP 2-4	27.30	4.84	22.46	measured 6/13/89
WP 2-5	27.20	4.70	22.50	measured 6/13/89
WP 2-6	26.79			unable to measure <sup>a</sup>
WP 2-7	26.35			unable to measure <sup>a</sup>
WP 2-8	27.74	8.78	18.96	
WP 2-9	27.89	9.07	18.82	
WP 2-10	26.45	8.09	18.36	
WP 2-11	27.20	7.64	19.56	
WP 3E-1	22.37	5.34	17.03	
WP 3E-2	23.34	6.82	16.52	
WP 3E-3	24.29	7.01	17.28	
WP 3E-4	21.44	4.34	17.10	
WP 3E-5	23.24	5.95	17.29	may contain surface water
WP 3E-6	24.14	7.63	16.51	
WP 3E-7	24.31	6.18	18.13	
WP 3E-8	24.51	5.51	19.00	
WP 3E-9	25.76	7.90	17.86	
WP 3W-1	22.95	5.46	17.49	
WP 3W-2	22.72	5.92	16.80	
WP 3W-3	21.31	3.32	17.99	
WP 3W-4	21.78	4.93	16.85	
WP 3W-5	22.26	2.43	19.83	
WP 4-1	27.81	3.46	24.35	
WP 4-2	25.85	2.33	23.52	
WP 4-3	22.92	4.14	18.78	
WP 5-1	25.11	1.52	23.59	may contain surface water
WP 5-2	25.32	1.71	23.61	may contain surface water
WP 5-3	28.01	4.34	23.67	
WP 6-1	29.00	15.72	23.29	
WP 6-2	29.29	6.21	23.08	
WP 6-3	28.69	5.48	23.21	
WP 7-1	25.02	3.96	21.06	
WP 7-2	25.31	5.01	20.30	
WP 7-3	23.96	2.63	21.33	
WP 7-4	25.71	7.10	18.61	
WP 7-5	23.47	5.04	18.43	
WP 7-6	23.75	5.34	18.41	
WP 7-7	23.93	5.80	18.13	
WP 8-1	25.29	2.63	22.66	
WP 8-2	25.63	3.52	22.11	
WP 8-3	26.07	3.51	22.56	

**Table 3-3  
(continued)**

Location	Top of Casing Elevation (ft)	Depth to Water (ft)	Groundwater Elevation (ft)	Comments
WP 8-4	24.08	2.01	22.07	
MW-A	27.30	3.70	23.60	monitor well installed by others
MW-B	26.95	3.38	23.57	monitor well installed by others
MW-C	27.69	4.10	23.59	monitor well installed by others

Note: All water level and top of casing survey measurements made by CH2M HILL. See Attachment 1 for locations.

<sup>a</sup>Interface probe would not pass joint in well screen.

**Table 3-4**  
**GROUNDWATER ELEVATION DATA FROM DECEMBER 4 AND 5, 1989**  
**(SECOND STEP OF THE SI)**  
**125TH FIGHTER INTERCEPTOR GROUP,**  
**FLORIDA AIR NATIONAL GUARD, JACKSONVILLE, FLORIDA**

Location	Date	Top of Casing Elevation (ft)	Depth to Water (ft)	Groundwater Elevation (ft)
MW 1-1	12/5/89	24.54	4.09	20.45
MW 1-2	12/5/89	22.32	1.89	20.43
MW 3E-1	12/4/89	24.05	5.50	18.55
MW 3E-2	12/4/89	23.55	5.32	18.23
MW 5-1	12/5/89	26.73	4.22	22.51
MW 5-2	12/5/89	26.77	4.22	22.55
MW 6-1	12/1/89	27.98	4.83	23.15
MW 6-2	12/1/89	25.54	2.70	22.84
MW 8-1	12/5/89	23.88	2.05	21.83
MW 8-2	12/5/89	24.00	2.29	21.71
MW 8-3	12/5/89	24.05	2.48	21.57
MW-A <sup>a</sup>	12/4/89	27.30	4.72	22.58
MW-B <sup>a</sup>	12/4/89	26.95	4.31	22.65
MW-C <sup>a</sup>	12/4/89	27.69	5.08	22.61

Note: All water level and top of casing survey measurements made by CH2M HILL. See Attachment 1 for locations.

<sup>a</sup>Monitor well installed by others

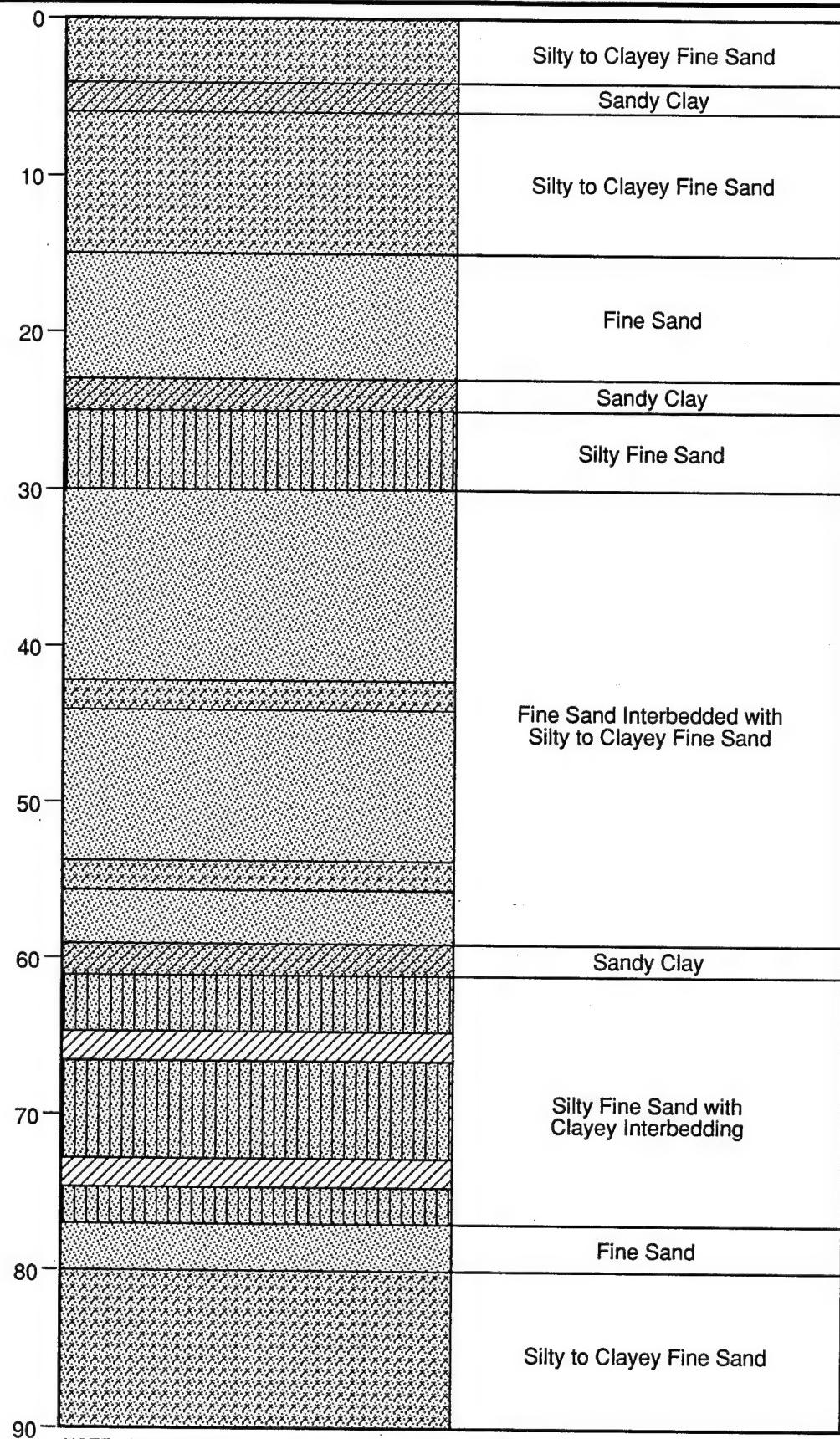
**Table 3-5**  
**GROUNDWATER ELEVATION DATA FROM NOVEMBER 5 AND 20, 1990,**  
**FOR SITE 6**  
**125TH FIGHTER INTERCEPTOR GROUP**  
**FLORIDA AIR NATIONAL GUARD, JACKSONVILLE, FLORIDA**

<u>Location</u>	<u>Date</u>	<u>Top of Casing Elevation (ft)</u>	<u>Depth to Water (ft)</u>	<u>Groundwater Elevation (ft)</u>
MW 6-1	11/05/90	27.98	5.30	22.68
MW 6-2	11/05/90	25.54	3.13	22.41
WP 6-4	11/05/90	30.02	8.05	21.97
WP 6-5	11/05/90	25.23	3.73	21.50
WP 6-6	11/05/90	28.60	7.76	20.84
MW 6-1	11/20/90	27.98	5.61	22.37
MW 6-2	11/20/90	25.54	3.45	22.09
WP 6-4	11/20/90	30.02	8.31	21.71
WP 6-5	11/20/90	25.23	3.98	21.25
WP 6-6	11/20/90	28.60	7.98	20.62

Note: All water level and top of casing survey measurements made by CH2M HILL.  
See Attachment 1 for locations.

**Table 3-6**  
**SLUG TEST ESTIMATES OF AQUIFER HYDRAULIC CONDUCTIVITY**  
**125TH FIGHTER INTERCEPTOR GROUP,**  
**FLORIDA AIR NATIONAL GUARD,**  
**JACKSONVILLE, FLORIDA**

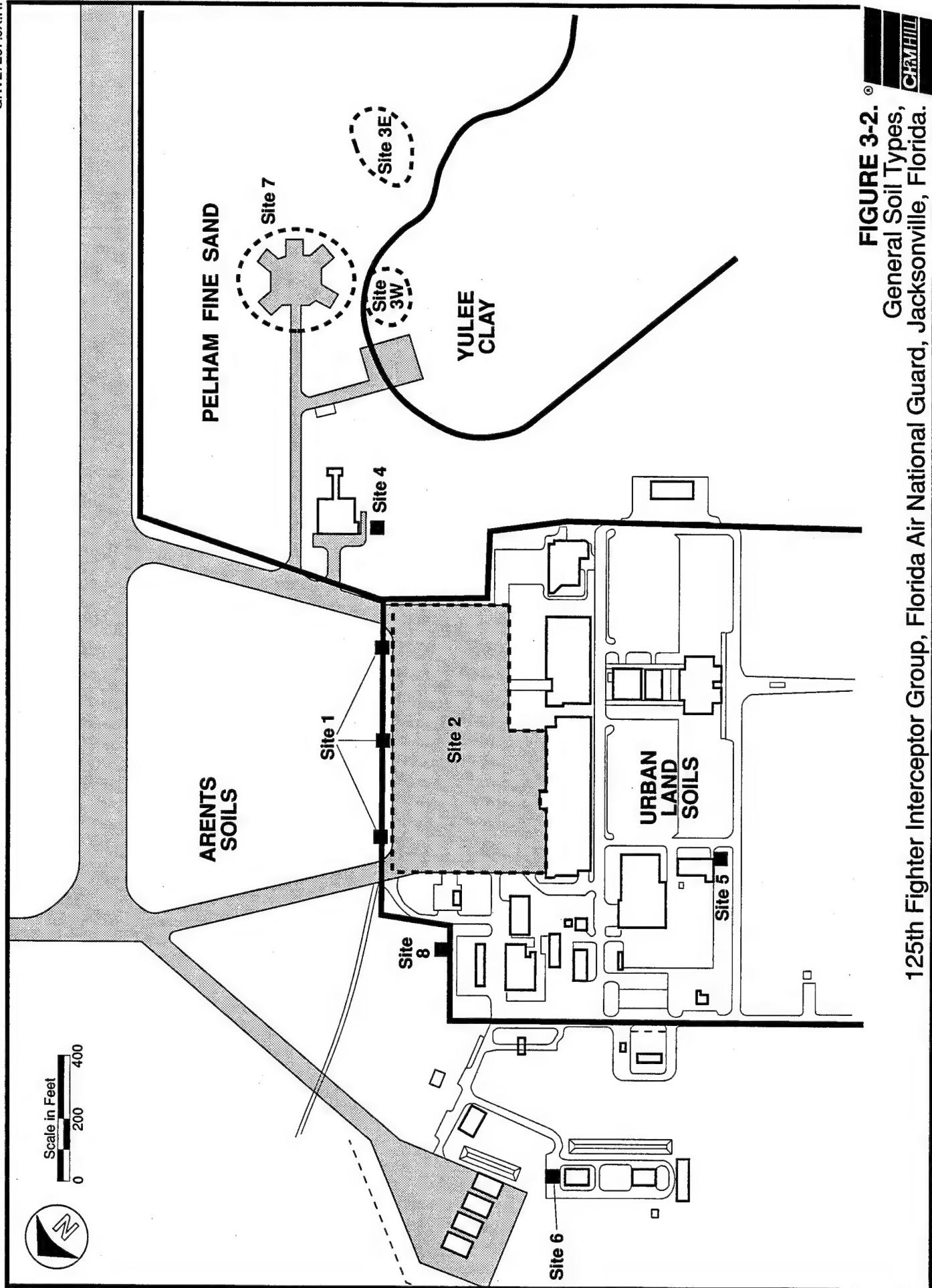
Site	Monitor Well	K (ft/day)
1	MW 1-1	1
3E	MW 3E-2	1
5	MW 5-2	2
6	MW 6-1	5
8	MW 8-1	2



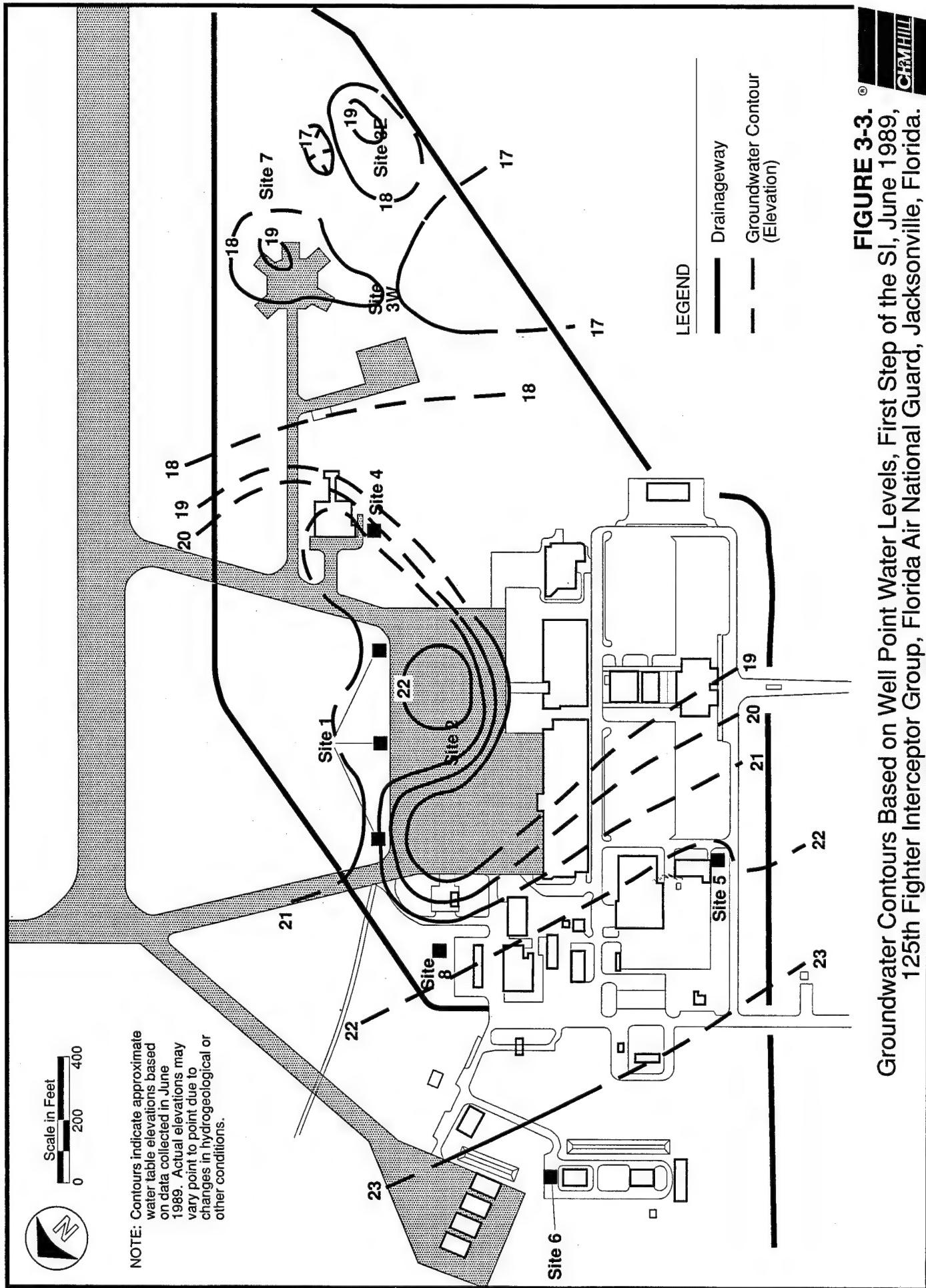
NOTE: Interpretations are based on approximate correlations between cone penetrometer data and geologic conditions.

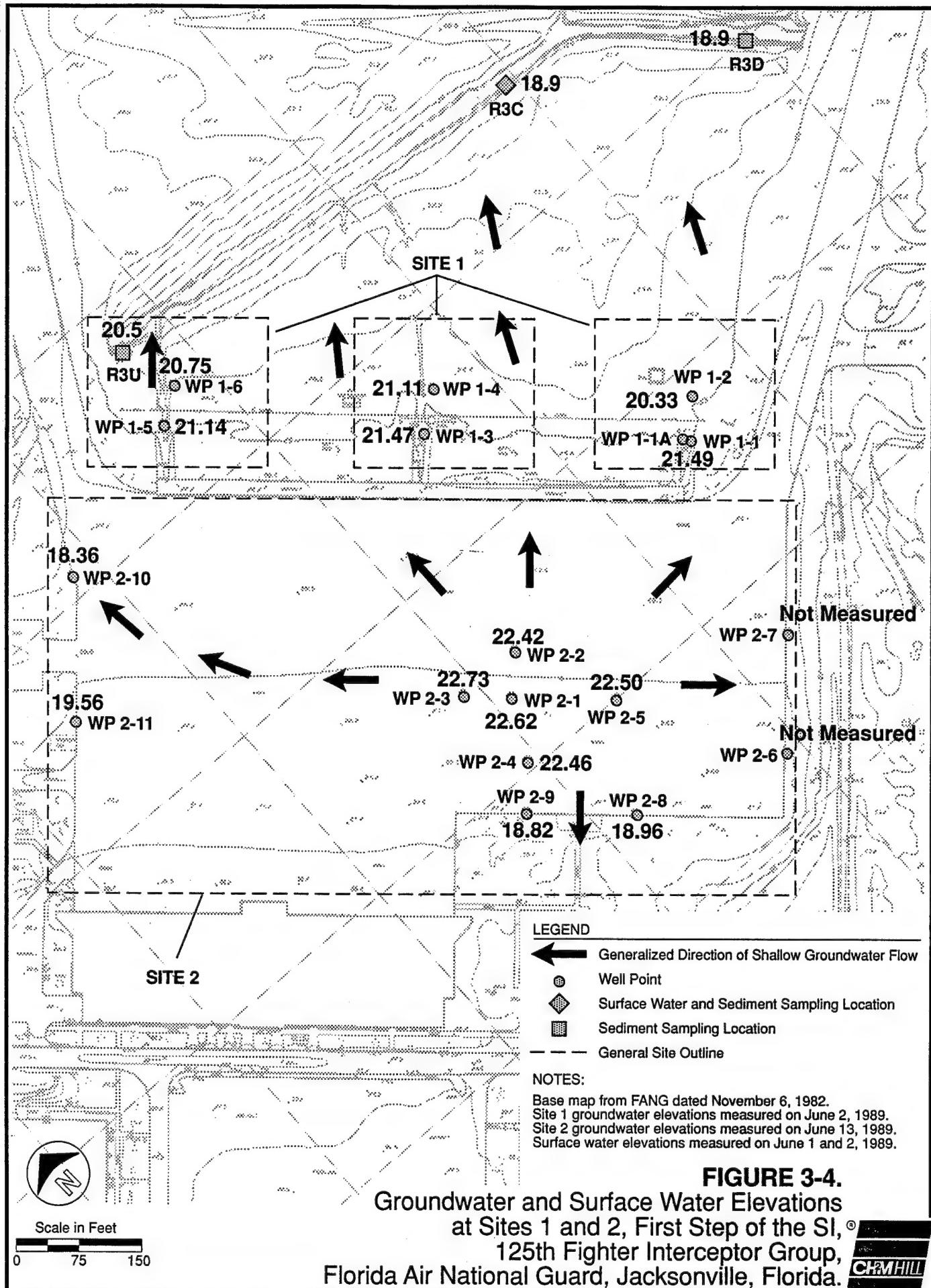
**FIGURE 3-1.**  
**Generalized Geologic Section Based on Piezocone Results, ©**  
**125th Fighter Interceptor Group,**  
**Florida Air National Guard, Jacksonville, Florida.**

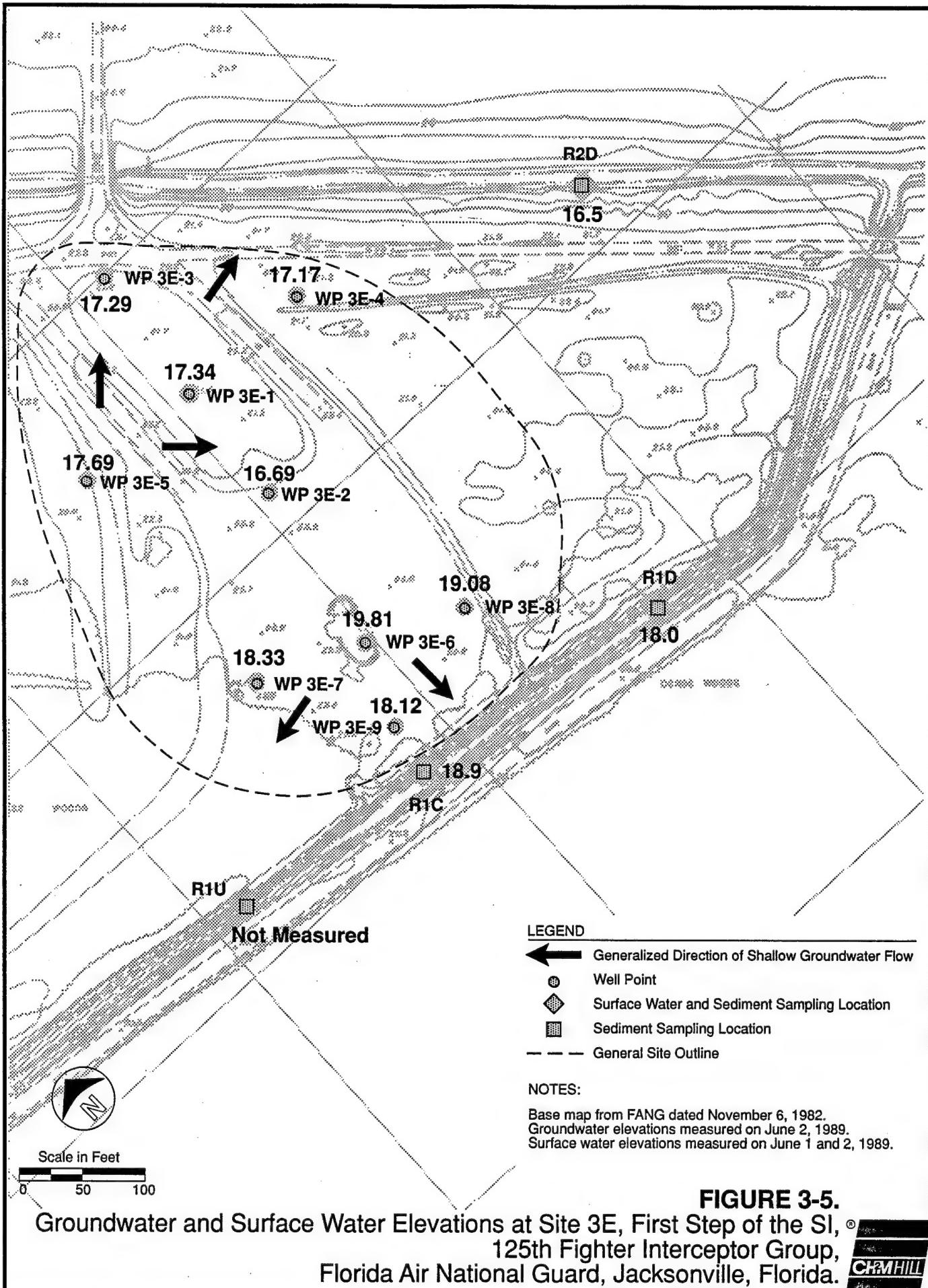


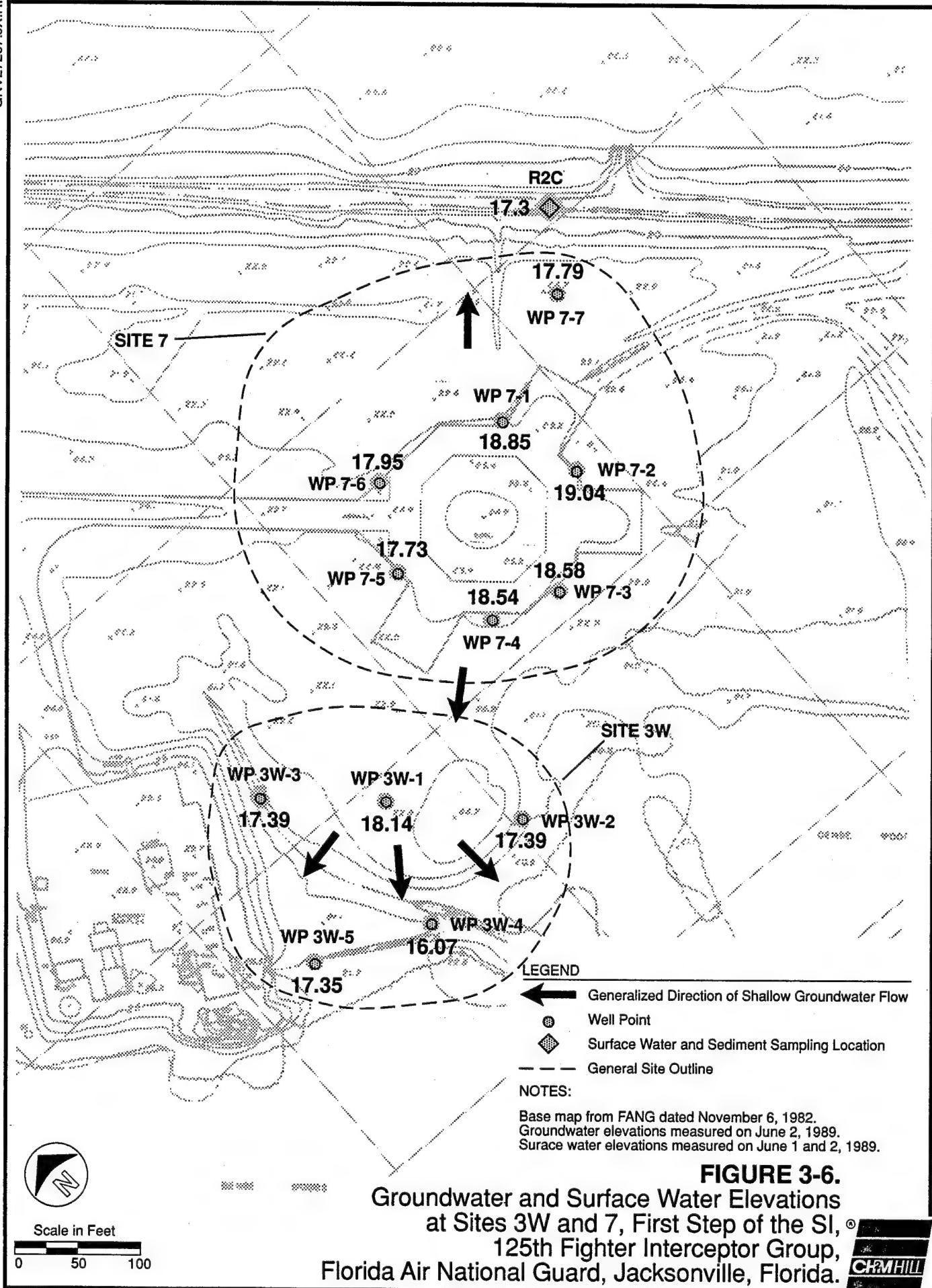


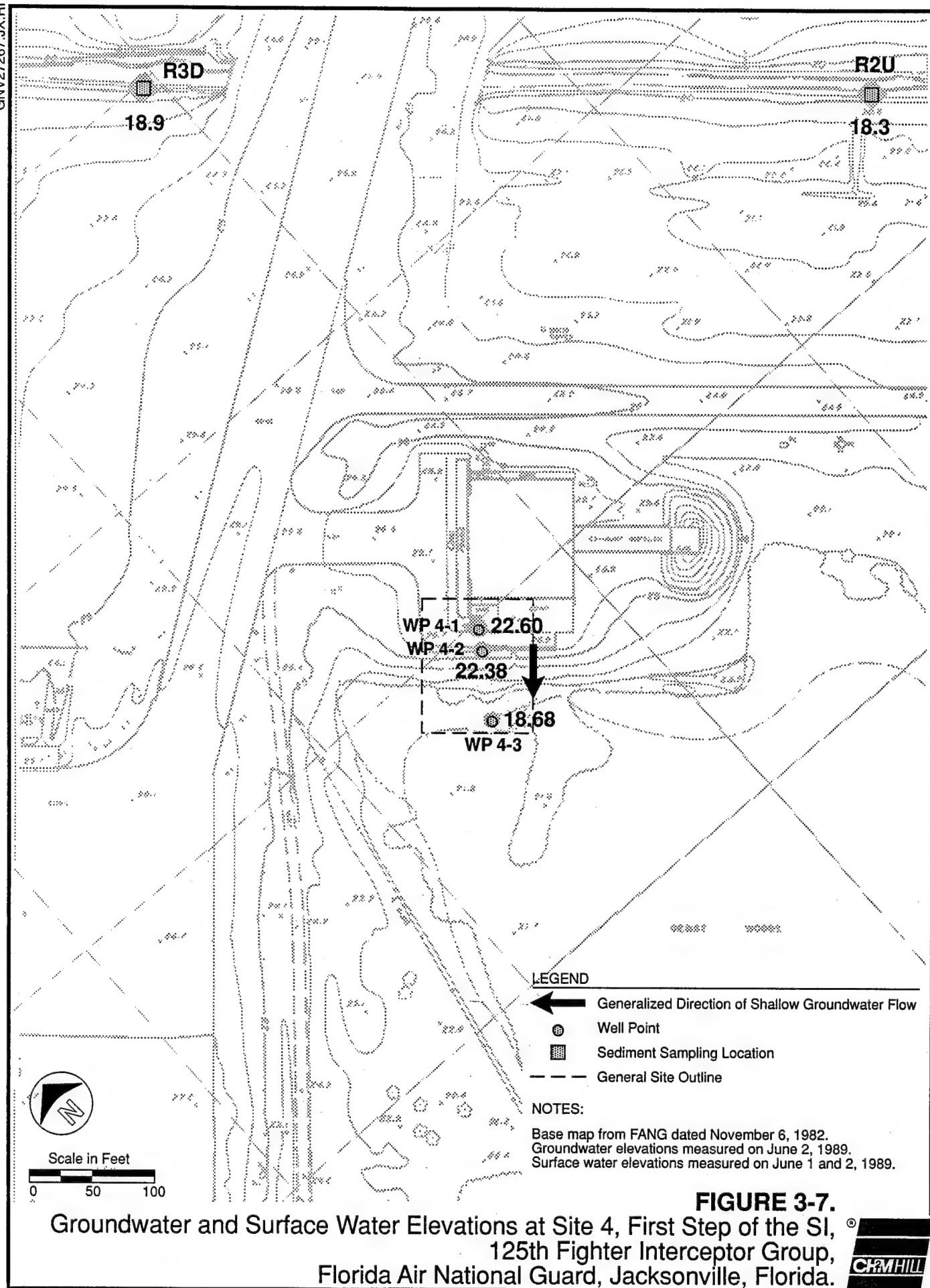
**FIGURE 3-2.**  
General Soil Types,  
125th Fighter Interceptor Group, Florida Air National Guard, Jacksonville, Florida.

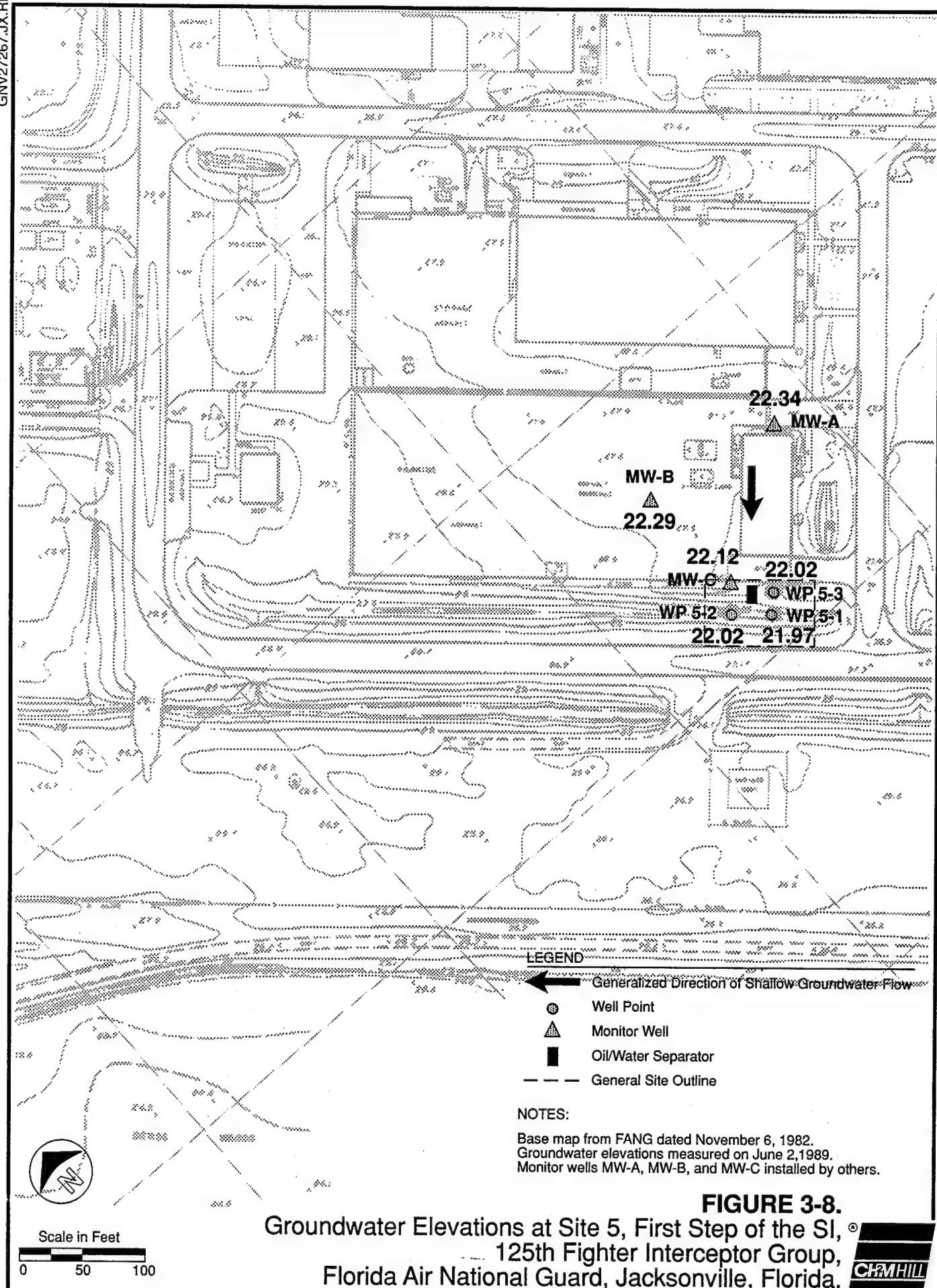


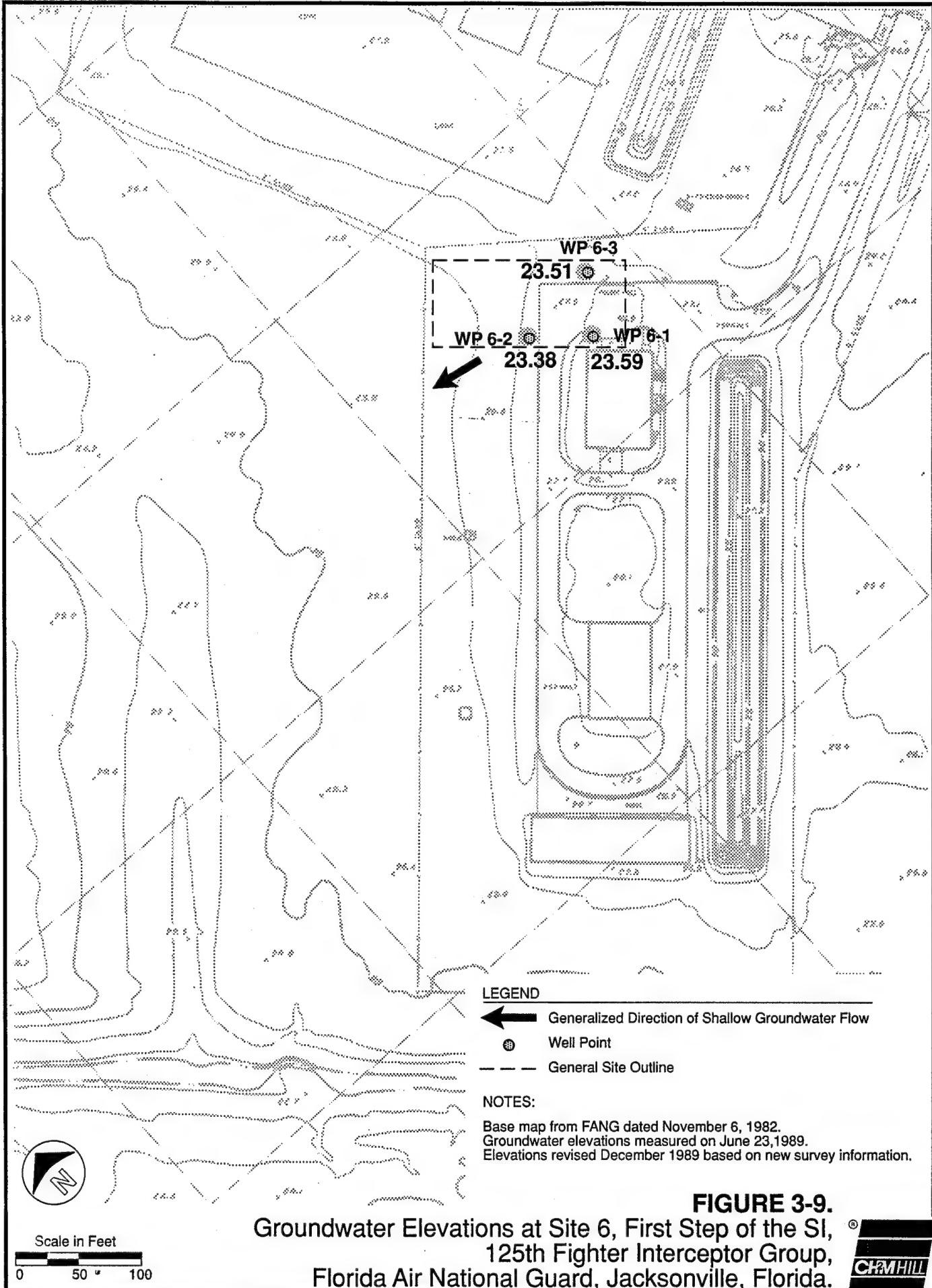


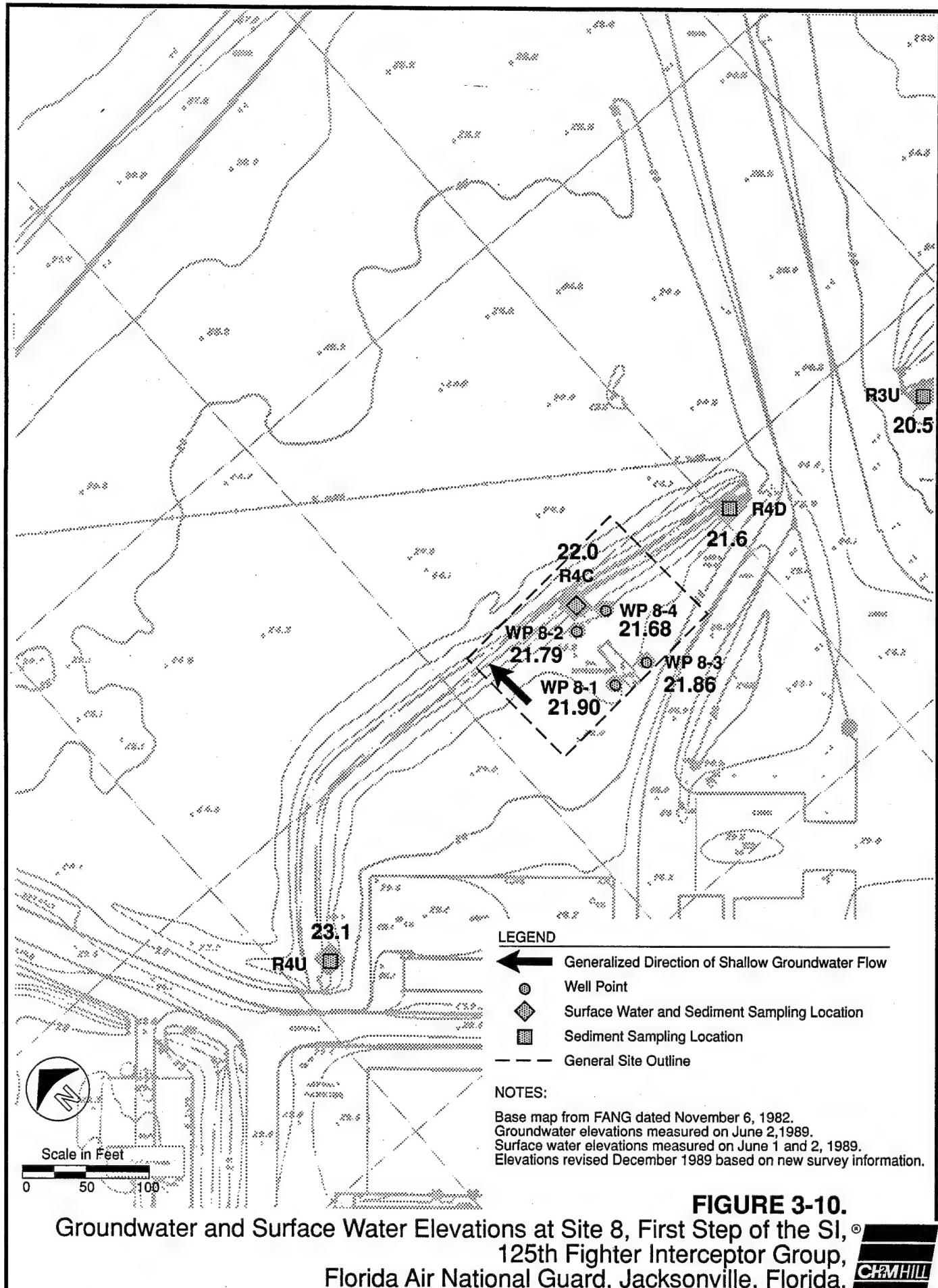


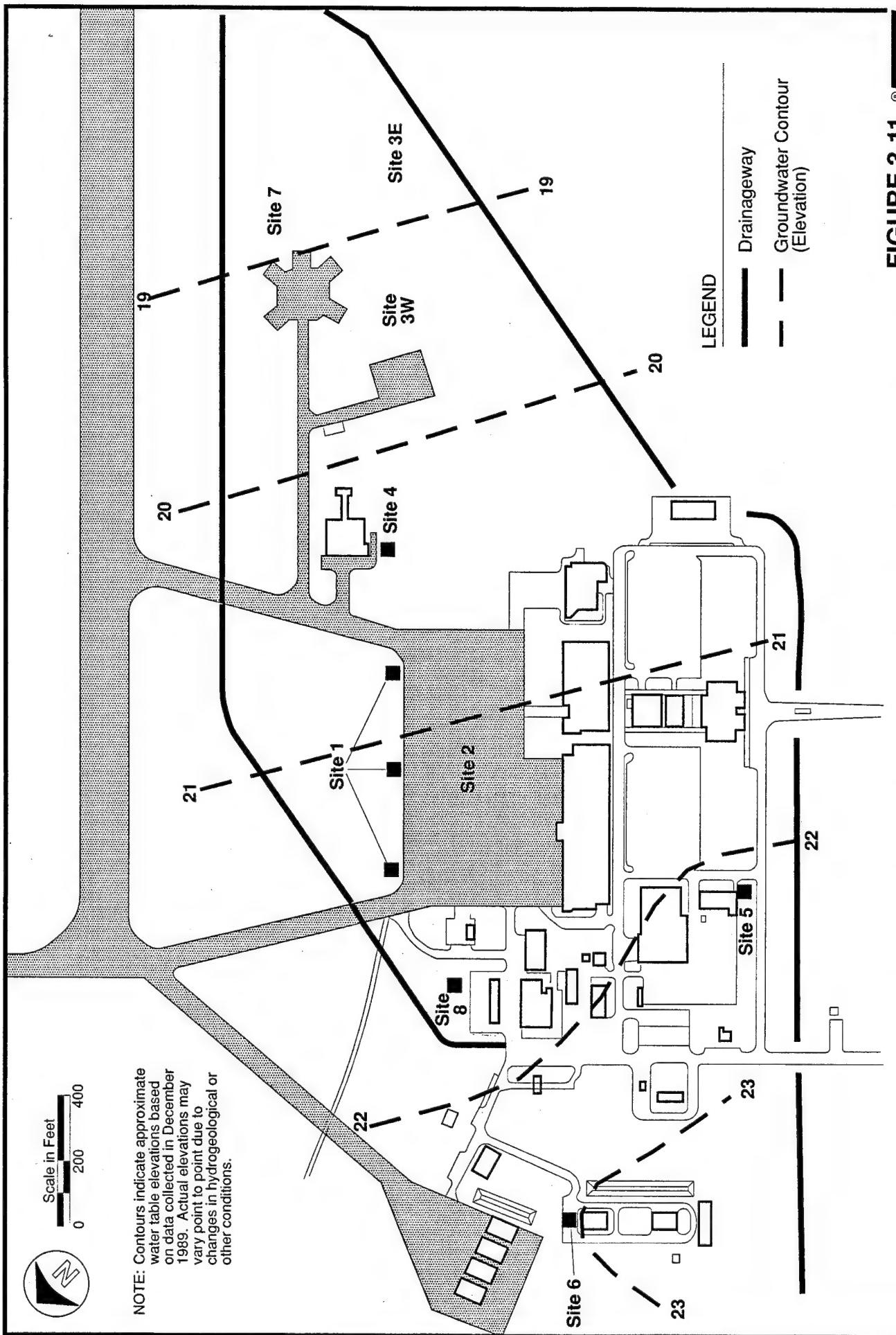




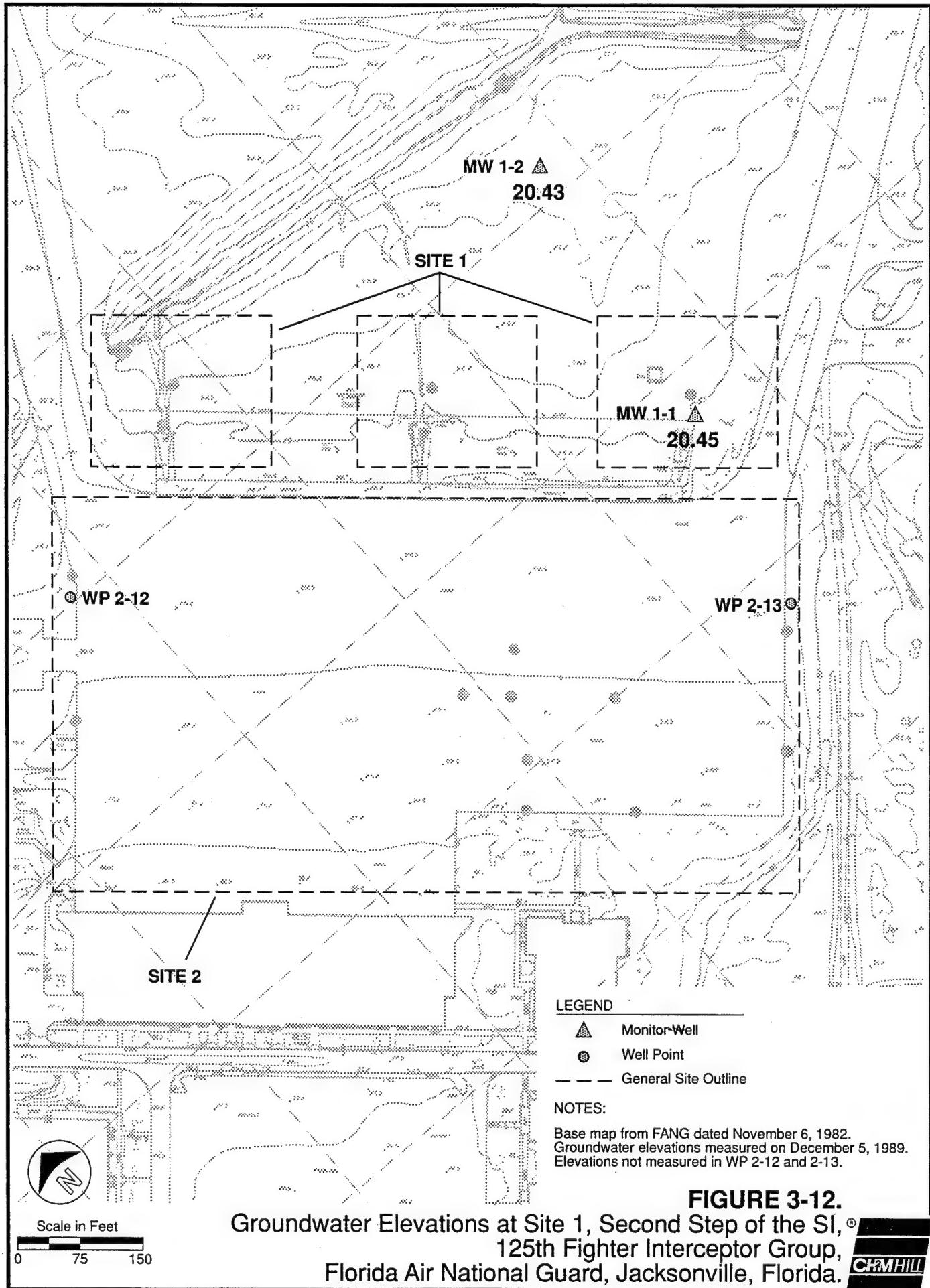


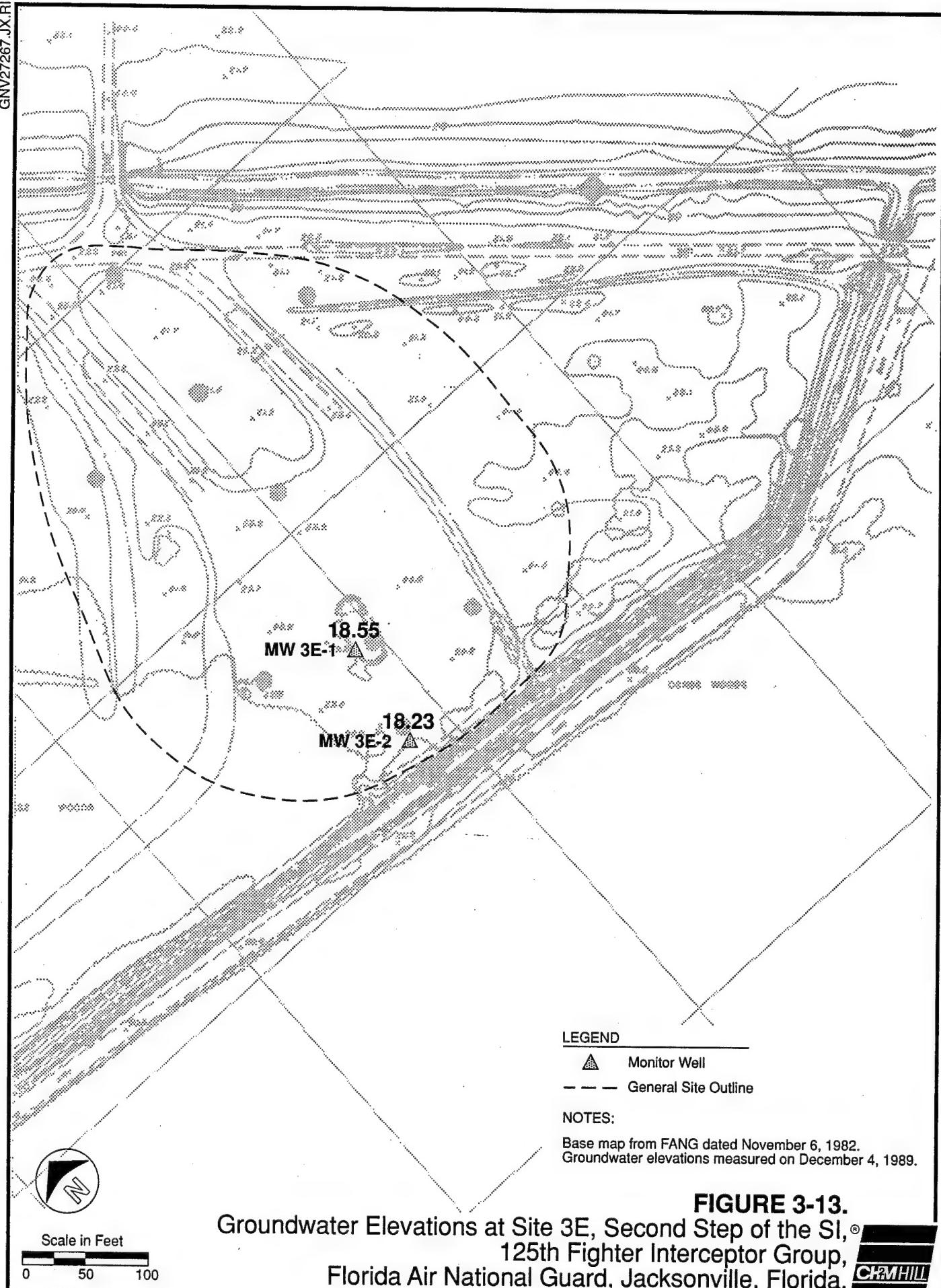


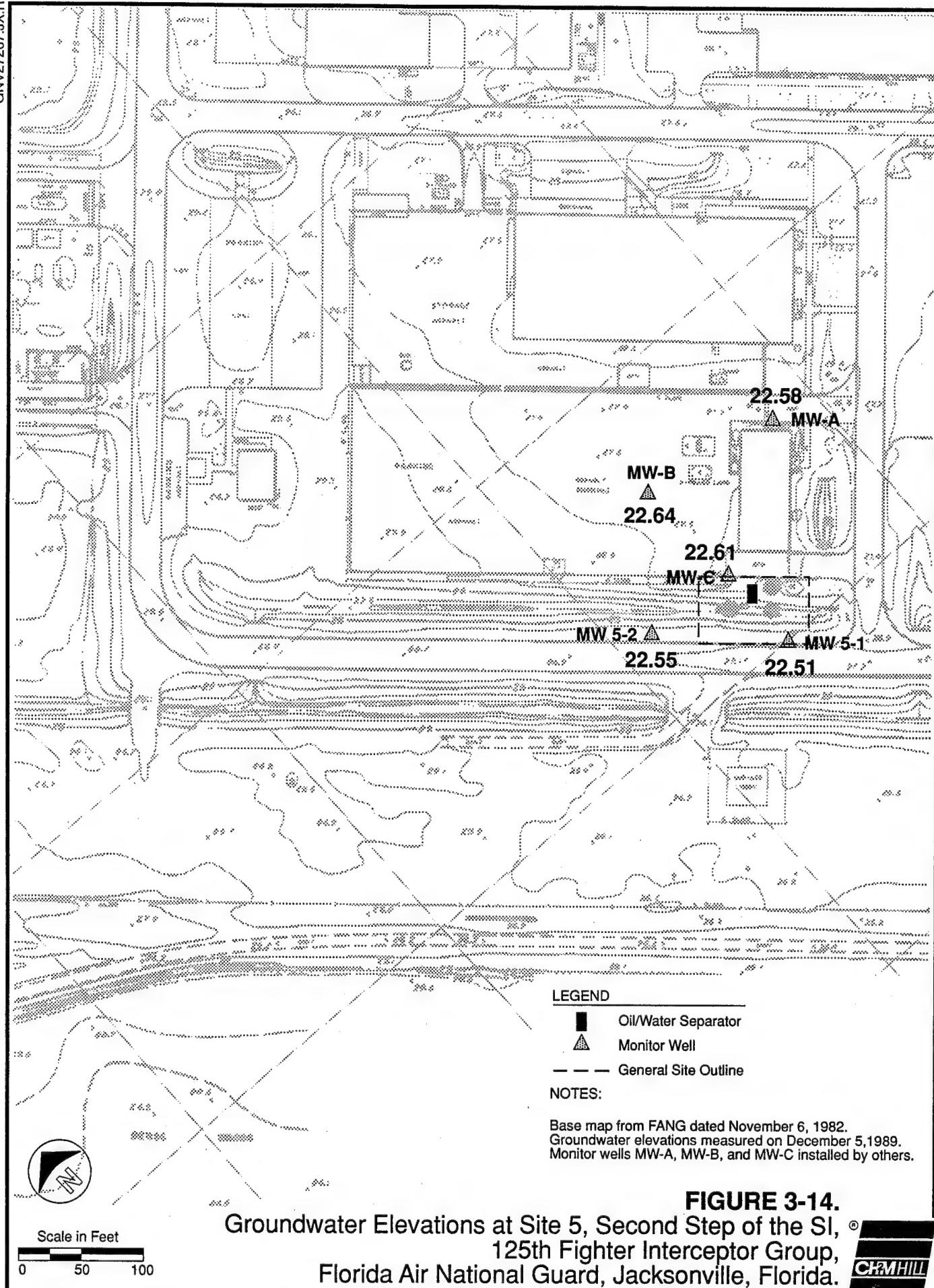


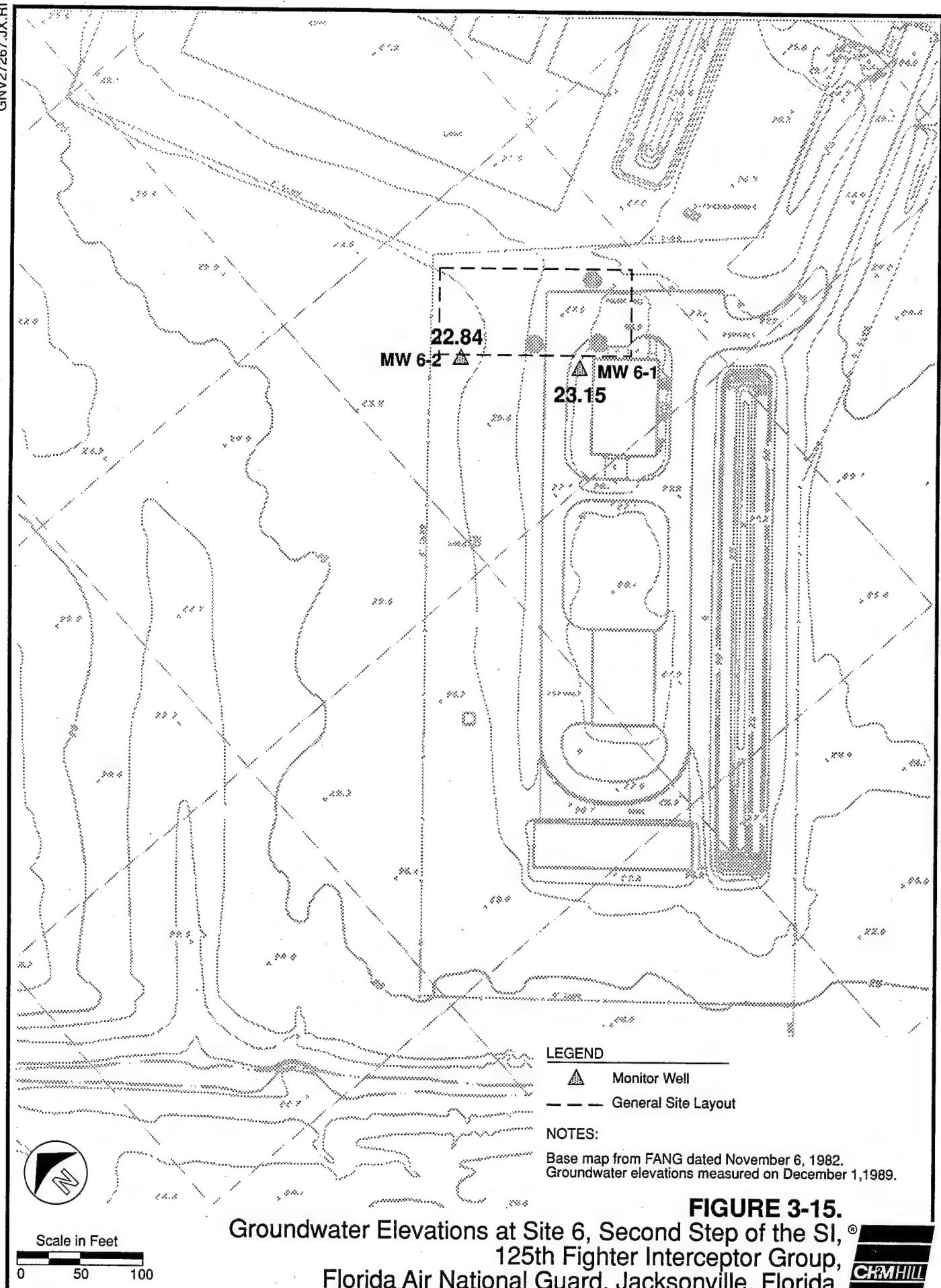


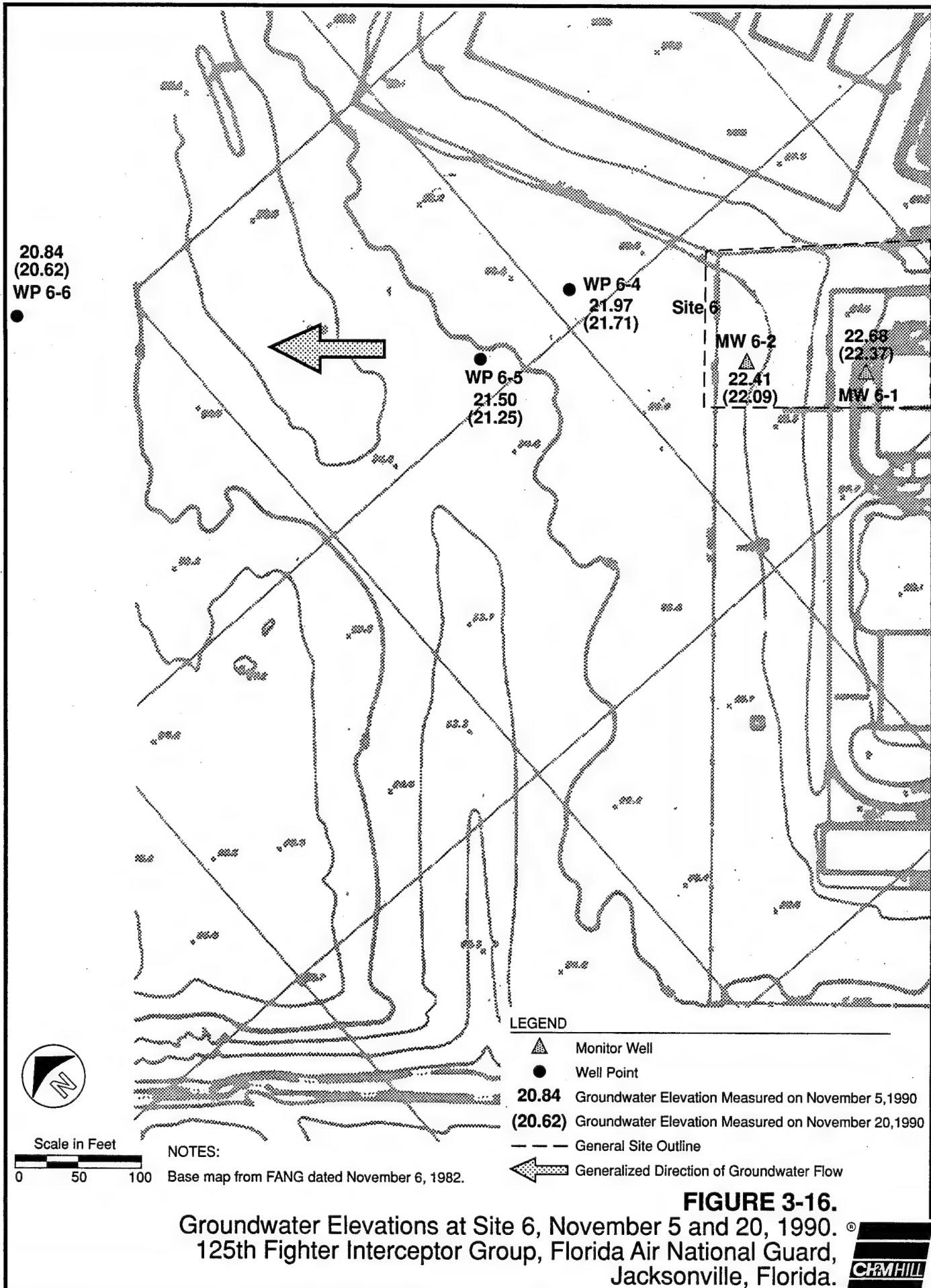
**FIGURE 3-11.** Groundwater Contours Based on Monitor Well Water Levels, Second Step of the SI, December 1989, 125th Fighter Interceptor Group, Florida Air National Guard, Jacksonville, Florida. **CHAMHILL**

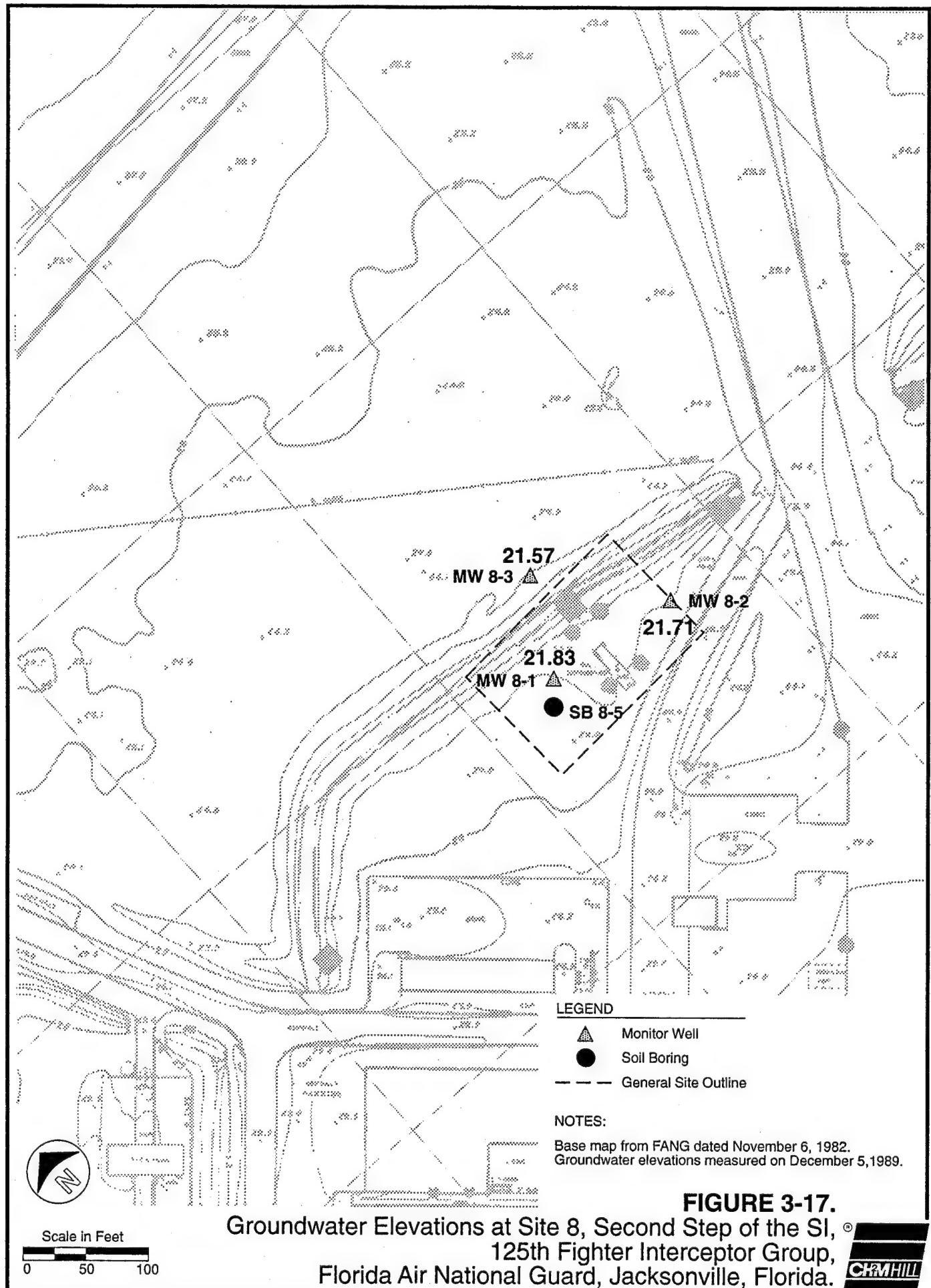












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**SECTION 4**  
*Data Validation Results*

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#### **4. DATA VALIDATION RESULTS**

The data quality objectives for the SI require data validation in accordance with Level C quality control (QC) guidelines promulgated by the Hazardous Waste Remedial Actions Program (HAZWRAP). Data validation for the first and second steps of the SI is described in detail in the technical memoranda included as Appendixes E and F of this report. A summary explanation of the validation process and results is presented in this section.

Laboratory analytical data generated from samples collected during the SI were prepared as data packages consisting of forms and control charts that conformed to the requirements for Level C deliverables. The forms presented and summarized the raw data and were reviewed against the criteria established in validation guidelines.

For this project, data validation was performed according to the guidelines presented by HAZWRAP for Level C when available. When analyses were not covered by these guidelines, data were reviewed against either laboratory data validation functional guidelines from the U.S. Environmental Protection Agency (EPA) or similar procedures outlining sample holding times, initial calibration, continuing calibration, matrix spike, blank spike, and blank versus sample results for the method involved.

The raw data were reviewed to verify sample identity, instrument calibration, detection limits, numerical computations, accuracy of transcriptions, and chemical interpretations. QC samples were processed to demonstrate that the analytical results were within laboratory prescribed criteria for accuracy and precision. Data were accepted without qualification when all QC and quality assurance measures were demonstrated to have been met.

For data that did not strictly meet the criteria, the data validation technical memoranda explain the reasons and provide tables that identify the affected data by letter flags. The flags also appear on the data summaries that are used as

tables in the report to indicate that there is some question about the quality of the analytical results reported.

Data that are found to be unusable are given an "R" qualifier. Such data are rejected because the compound may or may not be present and the data are not considered suitable for use in a preliminary risk assessment. No data from the SI were rejected.

Two groundwater samples (3E-GW-WP8 and 1-GW-WP4) exceeded holding times for analysis of volatile aromatic compounds. No reportable concentrations of these analytes were measured in the samples. Losses of volatile organics may have occurred in these samples, which creates some uncertainty in the data. Samples from other well points and monitor wells in the vicinity of the affected well points suggest volatile organics are not widespread at these sites.

Constituents that were detected in sample blanks included bis(2-ethylhexyl)phthalate, acetone, chromium, lead, and chloroform. Analytes that were identified at concentrations less than five times the value in the laboratory blanks were flagged with a "B" qualifier. These data may be eliminated from consideration in the preliminary risk assessment, particularly for common laboratory contaminants, if they appear to be unrelated to the sites.

Data may be flagged if biases may be present or concentrations are estimated, such as with unacceptable surrogate spike recoveries and/or precision criteria. In such circumstances, the reported constituents are known to be present but there is uncertainty about the concentrations. These data are used in risk assessments as positive results but do create uncertainties in the associated risk estimates.

For both steps of the SI, the laboratory organics and inorganics data were reviewed and validated using the HAZWRAP Level C and EPA guidelines and were found to be acceptable with the qualifications detailed in Appendixes E and F. Wet chemistry data were reviewed and validated using HAZWRAP Level C guidelines and were accepted without qualification.

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**SECTION 5**  
*Sampling and Analysis Results*

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## 5. SAMPLING AND ANALYSIS RESULTS

### 5.1 FIRST STEP OF THE SITE INVESTIGATION

The results from the first step of the SI include data from soil organic vapor headspace analyses, floating hydrocarbon measurements, and laboratory analyses of surface water, groundwater, soil, and sediment samples. Data validation for the laboratory analyses is discussed briefly in Section 4 and more completely in the technical memorandum provided as Appendix E.

The nature and extent of the contamination related to past activities at the eight sites at FANG is discussed in this section. Where appropriate, water quality data are compared to maximum contaminant levels (MCLs) specified in Florida drinking water standards, recommended groundwater criteria from FDER<sup>4</sup>, or surface water criteria from FAC Chapter 17-3.

#### 5.1.1 Soil Organic Vapor Headspace Analyses

Fifteen of the 54 soil samples had an OVA reading in excess of 500 ppm, which is the FAC Chapter 17-70 criterion for excessive petroleum hydrocarbon contamination in soils. The criterion was exceeded in one or more soil samples from Sites 1, 2, 3E, 4, and 8. The results of the soil organic vapor headspace analyses are shown in Table 5-1.

Several of the samples for headspace analyses were split; the split sample was analyzed immediately and the other was cooled and analyzed later in the day, as described in the *Site Investigation Sampling and Analysis Plan*<sup>2</sup>. No clear trend was seen in the split samples, although most of the later OVA readings were higher. Many soil samples exhibited an odor characteristic of swampy organic soils, and some with high OVA readings had no petroleum hydrocarbon odors, staining, or other contamination characteristics. Methane produced from degradation of naturally occurring organics or organic contaminants may be the cause of some high OVA readings. Laboratory analyses of the soils (see Section 5.1.4) confirmed the qualitative evidence of little or no petroleum hydrocarbon contamination of soils.

### **5.1.2 Floating Hydrocarbon Measurements**

Because of the large quantities of fuel reportedly spilled at several sites, the well points were checked for the presence of floating hydrocarbons. An oil/water interface probe was used to detect measurable thicknesses of floating hydrocarbons, and the groundwater in the well points was visually examined during sampling for hydrocarbon sheen. Neither floating hydrocarbons nor hydrocarbon sheen was detected in any of the well points.

### **5.1.3 Groundwater Contaminant Concentrations**

Groundwater samples from all well points were analyzed by CH2M HILL for volatile organics as indicator parameters, using EPA Methods 601, 602, or 624. Semivolatile organics (EPA Method 625), polynuclear aromatics (EPA Method 610), ethylene dibromide (EDB), and priority pollutant metals were analyzed for in samples taken from well points believed to be the most contaminated at the sites, as indicated by well point location, soil observations, and OVA readings. For selected samples, analyses were performed to obtain total organic carbon (TOC) data. Total suspended solids (TSS) concentrations were obtained for selected samples to evaluate the effect of solids on metals levels.

The laboratory results for volatile organic constituents are summarized in Table 5-2. Groundwater samples from 16 well points showed concentrations in excess of MCLs or FDER criteria. EPA Method 610 and 625 analysis results for polynuclear aromatics, semivolatile organics, and EDB are listed in Table 5-3; semivolatiles were detected in four well points and polynuclear aromatics in one well point. EDB was not detected in any of the groundwater samples analyzed, and naphthalene occurred at levels exceeding the Florida criteria in two well point samples.

As shown in Table 5-4, metals were detected at levels above the Florida criteria in eight groundwater samples. The chromium criterion was exceeded in four well points and the lead criterion was exceeded in five. Table 5-4 also includes results from TSS analyses; the high values reflect the siltiness of many of the well point

samples. Soils contain naturally occurring metals and dissolved metals tend to sorb onto soil particles. Because the reported metals concentrations for groundwater are total values, the high levels of solids in the samples may account for some of the metals detected.

Groundwater sample analysis results at each site are summarized below (concentration values followed by a "J" are estimated):

- Site 1: WP 1-1A exceeded the guidance criterion for total volatile organic aromatics (VOAs) (combined total of benzene, toluene, ethyl benzene, and total xylenes of 50  $\mu\text{g/l}$ ) at 55J  $\mu\text{g/l}$ . The detected benzene concentration of 41  $\mu\text{g/l}$  exceeded the 1  $\mu\text{g/l}$  MCL and the detected lead concentration of 54.1J  $\mu\text{g/l}$  exceeded the 50  $\mu\text{g/l}$  MCL. The lead MCL was also exceeded in WP 1-2 with a concentration of 66.3  $\mu\text{g/l}$ . The 50  $\mu\text{g/l}$  chromium standard was exceeded in WP 1-2 with a detected concentration of 99.3  $\mu\text{g/l}$ .
- Site 2: Benzene concentrations in WP 2-1 and 2-6 exceeded the MCL of 1  $\mu\text{g/l}$  with values of 5 and 2  $\mu\text{g/l}$ , respectively. The guidance criterion for ethyl benzene of 2  $\mu\text{g/l}$  was exceeded in WP 2-1 and 2-10 with detected concentrations of 7J and 3J  $\mu\text{g/l}$ , respectively. Total xylenes and total VOA guidance criteria (both 50  $\mu\text{g/l}$ ) were exceeded in WP 2-2 at detected concentrations of 160J  $\mu\text{g/l}$ . The lead criterion of 50  $\mu\text{g/l}$  was exceeded in WP 2-6, 2-9, and 2-10 at detected concentrations of 1,200J, 1,100J, and 640J  $\mu\text{g/l}$ , respectively.
- Site 3E: The sample from WP 3E-9 exceeded the 1  $\mu\text{g/l}$  vinyl chloride MCL with a detected concentration of 4J  $\mu\text{g/l}$  and the 4.2  $\mu\text{g/l}$  guidance criterion for trans-1,2-dichloroethene with a detected concentration of 12J  $\mu\text{g/l}$ . WP 3E-6 exceeded the 1  $\mu\text{g/l}$  MCL for benzene, the 2  $\mu\text{g/l}$  guidance criterion for ethyl benzene, and the 50  $\mu\text{g/l}$  guidance criterion for total VOAs with detected concentrations of 25, 4J, and 53J  $\mu\text{g/l}$ , respectively.

- Site 3W: No exceedances were noted.
- Site 4: The 2  $\mu\text{g/l}$  ethyl benzene guidance criterion was exceeded in WP 4-1 at a concentration of 4J  $\mu\text{g/l}$ . This well point also had reported concentrations of 1,300J  $\mu\text{g/l}$  of benzoic acid and 210  $\mu\text{g/l}$  of 4-methyl phenol.
- Site 5: The 1  $\mu\text{g/l}$  benzene MCL, the 2  $\mu\text{g/l}$  guidance criterion for ethyl benzene, and the 50  $\mu\text{g/l}$  total VOA criterion were exceeded in WP 5-3 with concentrations of 60, 19J, and 81J  $\mu\text{g/l}$ , respectively.
- Site 6: The 2  $\mu\text{g/l}$  ethyl benzene criterion was exceeded in WP 6-1 at a concentration of 6J  $\mu\text{g/l}$ . The 50  $\mu\text{g/l}$  chromium MCL was exceeded in WP 6-1, 6-2, and 6-3 at detected concentrations of 113, 56.8, and 115  $\mu\text{g/l}$ , respectively.
- Site 7: No exceedances were noted.
- Site 8: The 10  $\mu\text{g/l}$  guidance criterion for combined 1,2- and 1,4-dichlorobenzene was exceeded in WP 8-1 at a detected concentration of 17J  $\mu\text{g/l}$ . The 10  $\mu\text{g/l}$  criterion for chlorobenzene was also exceeded with a detected concentration of 35J  $\mu\text{g/l}$ . The 1  $\mu\text{g/l}$  MCL for benzene was exceeded at a concentration of 7  $\mu\text{g/l}$  in WP 8-1, which is located where an unlined pit was used as an OWS prior to 1981. WP 8-3 exceeded the 10  $\mu\text{g/l}$  criterion for combined 1,2- and 1,4-dichlorobenzene at a concentration of 34J  $\mu\text{g/l}$ . The 1  $\mu\text{g/l}$  benzene standard, the 24  $\mu\text{g/l}$  criterion for toluene, the 2  $\mu\text{g/l}$  criterion for ethyl benzene, the 50  $\mu\text{g/l}$  criterion for total xylenes, and the 50  $\mu\text{g/l}$  total VOA criterion were all exceeded in WP 8-3 at concentrations of 26, 39, 150J, 430, and 645J  $\mu\text{g/l}$ , respectively. The 10  $\mu\text{g/l}$  criterion for naphthalene was also exceeded in WP 8-3 at a concentration of 89  $\mu\text{g/l}$ . The 50  $\mu\text{g/l}$  total VOA criterion was exceeded in WP 8-4 at a detected

concentration of 58 µg/l. The total xylenes criterion was also exceeded in WP 8-4, at a detected concentration of 55 µg/l.

#### **5.1.4 Soil Contaminant Concentrations**

Soil samples were obtained near selected well point locations at selected depths and analyzed for volatile organics, semivolatile organics, polynuclear aromatics, EDB, TOC, polychlorinated biphenyls (PCBs), and metals. A background soil sample was also collected during the second step of the SI from a location not associated with known activities at FANG (see Attachment 1) and analyzed for metals. The results are provided here for comparison with soil samples collected during the first step of the SI.

As shown in Table 5-5, polynuclear aromatics were not detected in any of the soil samples and the only volatile constituent was total xylenes in WP 4-3. The summary of TOC, EDB, PCB, and semivolatile organics data in Table 5-6 shows that EDB and PCBs were not detected in any of the soil samples. The only semivolatile organic constituent detected was bis(2-ethyl-hexyl)phthalate, which was also found in the laboratory method blank.

In the metals data summary in Table 5-7, the highest chromium concentration is 8,600 µg/kg in WP 8-1. The average chromium level is 2,700 µg/kg, as compared to a reported background concentration of 1,800 µg/kg. Lead was detected at the highest concentration next to WP 8-3 (14,700 µg/kg), while the remaining samples averaged 4,000 µg/kg. The lead concentration reported for the background sample is 3,400 µg/kg.

#### **5.1.5 Drainageway Contaminant Concentrations**

Sediment and surface water samples were collected and analyzed for volatile organics, semivolatile organics, EDB, PCBs, and metals. A background sediment sample was also obtained from a location not associated with known activities at FANG (see Attachment 1) and analyzed for metals.

A summary of volatiles analysis results is given in Table 5-8 and shows volatiles were detected in samples from 6 of the 15 sediment sampling locations and 3 of the 5 surface water sampling locations. The water quality criteria for Class III surface waters in FAC Chapter 17-3.121 do not address volatile organics. None of the volatile organics detected are covered by federal ambient water quality criteria for aquatic organisms.

Table 5-9 summarizes data for semivolatile organics, EDB, and PCBs for sediment and surface water samples. Semivolatile organics were detected in samples from nine of the sediment and one of the surface water sampling locations. EDB was detected in one surface water sample but no sediment samples. No PCBs were detected in any of the sediment samples. The criteria in FAC Chapter 17-3.121 and 17-3.061 for phthalate esters and phenolic compounds are also shown in Table 5-9 and are exceeded for several samples. Phthalates are common laboratory contaminants and were not detected at concentrations much above detection limits.

A summary of the metals data for sediment and surface water samples is provided in Table 5-10 along with the criteria for Class III surface waters from FAC Chapter 17-3.121. Cadmium and chromium were detected at levels above the criteria in surface water samples from R2C and R4C. Silver was found in surface water in concentrations exceeding the criterion at two sample locations. Lead and mercury surface water criteria were each exceeded at one location.

Sample analysis results for each reach are summarized below:

- Reach 1: Several volatile organics were detected in sediment samples. Trichlorofluoromethane was found at all three sampling locations and total xylenes were detected at R1D. No other contamination was evident in Reach 1 sediments. The surface water sample at R1C contained 4.7 µg/l of silver, which exceeds the Class III surface water criterion of 0.07 µg/l. Bis(2-ethyl-hexyl)phthalate was also detected at 6 µg/l, above the 3 µg/l criterion, but may be attributable to laboratory contamination.

Mercury above the 0.2 µg/l criterion was detected in the R1C surface water sample at a concentration of 0.68 µg/l and was also detected at 0.6 µg/l in the rinsate blank.

- Reach 2: Minimal contamination was evident in sediment samples. Water samples from R2C indicated cadmium at 9.3 µg/l and chromium at 63.4 µg/l, levels that exceed the Class III surface water criteria of 0.8 to 1.2 µg/l and 50 µg/l, respectively.
- Reach 3: Lead levels appeared high at R3C and total xylenes were detected at R3U in sediment samples.
- Reach 4: Toluene, ethyl benzene, and total xylenes were detected in sediment samples at R4C, which also appeared to have high levels of chromium and lead. The sediment sample at R4U, which was the most upstream sampling point on any of the drainageways associated with the eight sites and therefore expected to have the least contamination, contained many semivolatile constituents. Phenanthrene, anthracene, fluoranthene, pyrene, benzo(a)anthracene, chrysene, bis(2-ethyl-hexyl)phthalate, benzo(b and k)fluoranthene, benzo(a)pyrene, indeno(1,2,3-cd)pyrene, benzo(g,h,i)perylene, and naphthalene were detected in the sediment at R4U. Sediment samples at R4U and R4C also contained high lead concentrations.

The contamination at R4U may have originated in OWS discharges to an upstream drainage ditch that is not included in this SI. The OWS collects drainage from a fuel storage facility and a fuel truck parking lot. The contaminants detected in the sediment sample at R4U are indicative of the heavy fuel constituents found in diesel fuels. Also, drainage from the AGE Storage Building enters the drainageway reach through a pipe discharge near R4U. The only semivolatiles detected in any of the other sediment samples in Reach 4 were bis(2-ethyl-hexyl)phthalate and naphthalene.

The surface water in Reach 4 also appeared to be the most contaminated of any sampled. The sample from R4C exceeded the 3 µg/l Class III surface water criterion for bis(2-ethyl-hexyl)phthalate with a detected concentration of 13 µg/l. The 1 µg/l phenol criterion was also exceeded at a concentration of 2,200 µg/l. The 50 µg/l chromium criterion, the 0.8 to 1.2 µg/l cadmium criterion, and the 30 µg/l lead criterion were all exceeded at concentrations of 122, 21.7, and 41.9 µg/l, respectively. The surface water contamination detected at R4C may reflect current discharges from the Wash Rack OWS and the upstream OWS.

## **5.2 SECOND STEP OF THE SITE INVESTIGATION**

The results from the second step of the SI include data from soil organic vapor headspace analyses, floating hydrocarbon measurements, and laboratory analyses of surface water, groundwater, soil, and sediment samples. Data validation for the laboratory analyses is discussed briefly in Section 4 and more completely in the technical memorandum provided as Appendix F.

The data results are discussed below as they relate to the nature and extent of contamination attributable to past activities at the eight sites and the downgradient drainageway locations investigated during the second step of the SI. Where appropriate, data are compared to MCLs specified in Florida drinking water standards or to recommended criteria as discussed in Section 5.1.

### **5.2.1 Soil Organic Vapor Headspace Analyses**

Results of soil organic vapor headspace analyses conducted during the first step of the SI indicated areas with potentially excessive soil contamination. During the second step of the SI, soil organic vapor headspace analyses were repeated at three of these locations (Sites 1, 2, and 4). The sampling locations for the headspace analyses are shown in Figures 5-1 and 5-2.

At each location, the soil sample from the hand auger was split into two portions. One portion was analyzed with the OVA as in the first step of the SI; the second portion was analyzed with an activated carbon filter on the OVA to obtain readings of methane concentrations alone.

The results of the headspace analyses are presented in Table 5-11. Readings with the filter are equal to or greater than readings without the filter, which indicates that methane is the dominant organic vapor detected in the soil. The total OVA readings were lower than had been reported during the first step of the SI, possibly because of the lower ambient air temperatures during the second sample collection effort.

### **5.2.2 Floating Hydrocarbon Measurements**

During the sampling of the monitor wells and well points installed as part of the second step of the SI, an oil/water interface probe was used to measure the depth to groundwater and the detectable thickness of any floating hydrocarbons that might be present. The water removed from the monitor wells and well points during purging and sampling was also visually inspected for hydrocarbon sheen. As observed during the first step of the SI, no floating hydrocarbons or hydrocarbon sheen was detected in any monitor wells or well points during the second step of the SI.

### **5.2.3 Groundwater Contaminant Concentrations**

Groundwater samples were collected from all monitor wells and well points installed during the second step of the SI, as well as from the three monitor wells installed by others adjacent to Site 5 as part of an ongoing UST investigation. The samples were analyzed for selected parameters based on the results of the groundwater sampling performed during the first step of the SI. Field-filtered samples were also collected from two well points at Site 2 for analysis of lead for comparison with unfiltered samples, as requested by FDER. Two samples were analyzed for iron, total dissolved solids (TDS), and total hardness to obtain information on the general water quality in the surficial aquifer.

The laboratory results for volatile organic constituents analyzed by EPA Methods 601 and 602 are summarized in Table 5-12. Groundwater samples from four monitor wells showed concentrations in exceedance of MCLs or FDER criteria. Samples for analysis of semivolatile constituents by EPA Method 610 were collected from the three monitor wells at Site 8, the two well points at Site 7, and the well point at Site 3W. No detectable concentrations of semivolatiles were found in any of these groundwater samples. The laboratory results for metals, TDS, and total hardness are summarized in Table 5-13. Florida drinking water standards were exceeded in four of the monitor wells sampled. Table 5-14 summarizes the results of the analysis of filtered and unfiltered samples from Site 6 for total chromium.

Tables 5-12 and 5-13 include values for decontamination water used for gross decontamination (initial rinse) of equipment. Decontamination water was obtained from a hose bib at the Hush House (denoted as HH) near Site 4 and from a hose bib at the Civil Engineering Building (denoted as CE). The EPA 601 parameters detected in these samples are trihalomethanes, organic compounds commonly formed as a result of chlorination at water treatment plants. The total trihalomethane concentration detected in each sample is well below the drinking water standard.

In general, the laboratory results for groundwater samples from the monitor wells show lower concentrations of contaminants than were detected in samples from well points in the same areas. Several factors may contribute to the difference. For instance, contaminants associated with fuel spills tend to be lighter than water and will float on top of the groundwater table, which well points typically penetrate by only 1 or 2 feet. Samples from well points will, therefore, contain water with greater concentrations of contaminants than those from monitor wells, which generally penetrate a deeper water column. In addition, because monitor wells are constructed to filter out more particulates, samples from well points may reflect more contaminants associated with suspended solids, such as metals.

Groundwater sample analysis results at each site are summarized below:

- Site 1: MW 1-1 exceeded the 50 µg/l primary drinking water standard for chromium with a concentration of 152 µg/l. MW 1-2 also exceeded the primary drinking water standard for chromium with a concentration of 112 µg/l and the 300 µg/l secondary standard for iron with a concentration of 41,300 µg/l.
- Site 2: No exceedances were noted.
- Site 3E: MW 3E-1 exceeded the primary drinking water standards for 1,1-dichloroethane (0.3 µg/l) and benzene (1 µg/l) with concentrations of 3.7 and 31 µg/l, respectively. Also in MW 3E-1, the guidance criteria for ethyl benzene (2 µg/l), total xylenes (50 µg/l), and total VOAs (50 µg/l) were exceeded with concentrations of 26, 110, and 175.1 µg/l, respectively. The secondary drinking water standards for TDS (500,000 µg/l) and iron (300 µg/l) were also exceeded in MW 3E-1 at concentrations of 1,860,000 and 241,000 µg/l, respectively.
- Site 3W: No exceedances were noted.
- Site 4: No samples were collected.
- Site 5: MW 5-2 exceeded the 1 µg/l primary drinking water standard for benzene with a concentration of 1.8 µg/l. MW-A, installed by others adjacent to Site 5, exceeded the 2 µg/l guidance criteria for ethyl benzene with a concentration of 36 µg/l. MW-C, also installed by others, exceeded the 1 µg/l primary drinking water standard for benzene with a concentration of 7.5 µg/l.
- Site 6: In the first samples obtained, MW 6-2 exceeded the 50 µg/l primary drinking water standard for chromium with a concentration of 128 µg/l. No chromium was detected in the subsequent filtered

samples from the two Site 6 monitor wells and the three well points. The unfiltered samples from WP 6-4 and WP 6-6 exceeded the standard at 286 and 1,650 µg/l, respectively. The unfiltered sample collected from MW 6-2 had a chromium concentration of 19.6 µg/l, which is below the standard.

- Site 7: No exceedances were noted. Chromium was not detected in the filtered sample collected from WP 7-8, but was detected at a concentration of 42 µg/l in the unfiltered sample.
- Site 8: No exceedances were noted.

#### **5.2.4 Soil Contaminant Concentrations**

At Site 8, soil samples were obtained from three borings drilled for monitor well construction and one additional soil boring. The soil samples were analyzed for barium, chromium, and lead, and the results are shown in Table 5-15. The barium and chromium concentrations in all but one soil sample exceed those found in the background sample. The lead concentrations in the soil samples at Site 8 are in the same range as the value for the background sample.

#### **5.2.5 Drainageway Contaminant Concentrations**

Sediment and surface water samples were collected at two locations on the drainageway downstream of FANG (DG-1 and DG-2 on Attachment 1) for analysis for volatile organics, semivolatile organics, and metals. For comparison, a background sediment sample was collected from a point on the FANG drainageway system not associated with any known activities at FANG (see Attachment 1). The background sediment sample reportedly contained 58 µg/kg of di-n-butylphthalate, a semivolatile organic constituent that is probably a laboratory contaminant.

A summary of the results of the metals analyses for sediment samples is given in Table 5-16. Barium is the only constituent at concentrations that significantly

exceed that of the background sample: 34,800 and 19,100 µg/kg at DG-1 and DG-2, respectively, as compared to 9,100 µg/kg for the background sample. No semivolatile organics were detected in either of the sediment samples, and the only volatile organic was chloroform at 1.5 µg/kg, a level that is probably attributable to laboratory contamination.

In the surface water samples from the drainageway, the mercury concentration at DG-2 of 0.35 µg/l exceeds the criterion of 0.2 µg/l. No detectable concentrations of volatile or semivolatile organics were found in the surface water samples at DG-1 and DG-2.

### **5.3 BACKGROUND SAMPLING**

To provide a comparison for samples taken from the eight sites and the drainageways, background soil and sediment samples were collected at locations not associated with any known activities at FANG during the second step of the SI (see Attachment 1). The background samples were analyzed for metals and the results are reported in Tables 5-7 and 5-15 for soils and Tables 5-10 and 5-16 for sediments. Background analyses were not performed for volatile or semivolatile contaminants, as such constituents are not naturally occurring in soils or sediments.

Background samples were not collected for either groundwater or surface water, as concentrations in such samples must be compared to FDER criteria. A location on the drainageway network at FANG that had clearly not been affected by installation activities could not be identified.

**Table 5-1**  
**RESULTS OF SOIL ORGANIC VAPOR HEADSPACE ANALYSES**  
**(FIRST STEP OF THE SI)**  
**125TH FIGHTER INTERCEPTOR GROUP,**  
**FLORIDA AIR NATIONAL GUARD, JACKSONVILLE, FLORIDA**

Well Point	Depth (ft)	OVA Reading (ppm)	Split (ppm)
WP 1-1	1.5 - 2.0	>1000	140
WP 1-2	2.0 - 2.5	>1000	N/A
WP 1-3	1.5 - 2.0	>1000	N/A
WP 1-4	2.0 - 2.5	820	N/A
WP 1-5	2.0 - 2.5	100	N/A
WP 1-6	2.5 - 3.0	60	N/A
WP 2-1	2.0 - 2.5	66	N/A
WP 2-1	4.0 - 4.5	420	N/A
WP 2-2	2.0 - 2.5	20	N/A
WP 2-2	4.0 - 4.5	140	N/A
WP 2-3	2.0 - 2.5	85	N/A
WP 2-3	4.0 - 4.5	220	N/A
WP 2-4	2.0 - 2.5	100	N/A
WP 2-4	4.0 - 4.5	100	N/A
WP 2-5	2.0 - 2.5	40	N/A
WP 2-5	4.0 - 4.5	130	N/A
WP 2-6	4.0 - 4.5	750	N/A
WP 2-7	4.0 - 4.5	1000	N/A
WP 2-8	4.0 - 4.5	1000	N/A
WP 2-9	4.0 - 4.5	750	N/A
WP 2-10	4.0 - 4.5	200	N/A
WP 2-11	4.0 - 4.5	800	N/A
WP 3E-1	NO SAMPLE	NO SAMPLE	N/A
WP 3E-2	3.5 - 4.0	10	0
WP 3E-3	4.0 - 4.5	40	N/A
WP 3E-4	3.5 - 4.0	50	N/A
WP 3E-5	5.0 - 5.5	20	N/A
WP 3E-6	2.0 - 2.5	500	990
WP 3E-7	3.0 - 3.5	800	N/A
WP 3E-8	NO SAMPLE	NO SAMPLE	N/A
WP 3E-9	3.0 - 3.5	100	N/A
WP 3W-1	3.5 - 4.0	5	N/A
WP 3W-2	5.0 - 5.5	0	N/A
WP 3W-3	3.5 - 4.0	5	N/A
WP 3W-4	2.5 - 3.0	0	N/A
WP 3W-5	3.0 - 3.5	0	N/A
WP 4-1	1.5 - 2.0	800	520
WP 4-2	3.0 - 3.5	850	N/A
WP 4-3	2.0 - 2.5	>1000	N/A
WP 5-1	1.0 - 1.5	58	N/A
WP 5-2	1.0 - 1.5	70	N/A
WP 5-3	3.0 - 3.5	150	N/A
WP 6-1	3.5 - 4.0	0	4
WP 6-2	3.5 - 4.0	0	N/A
WP 6-3	3.5 - 4.0	0	N/A
WP 7-1	3.5 - 4.0	15	N/A
WP 7-2	3.5 - 4.0	0	N/A
WP 7-3	3.5 - 4.0	40	N/A
WP 7-4	4.0 - 4.5	0	N/A
WP 7-5	2.5 - 3.0	100	N/A
WP 7-6	5.5 - 6.0	60	N/A
WP 7-7	3.5 - 4.0	0	N/A
WP 8-1	1.5 - 2.0	>1000	380
WP 8-2	2.0 - 2.5	180	N/A
WP 8-3	1.5 - 2.0	30	N/A
WP 8-4	1.5 - 2.0	350	N/A

Table 5-2  
SUMMARY OF GROUNDWATER SAMPLE ANALYSES FOR VOLATILES (ug/l)  
FIRST STEP OF THE SI  
123RD FIGHTER INTERCEPTOR GROUP, FLORIDA AIR NATIONAL GUARD  
JACKSONVILLE, FLORIDA

Location	EPA METHOD 601										EPA METHOD 602										EPA METHOD 624														
	3800 A	2400 A	200 B	1 B	4.2 A	10 A	10,75 A	1 B	24 A	10 A	2 A	50 A	10 A	10 A	75 B	50 A	1,1-Di-chloro-Trichloro-methane	1,1,1-Chloro-Ethane	trans-1,2-Dichloro-ethylene	Chloro-chloro-benzene	Benzene	Chloro-chloro-benzene	Total Methylene Xylenes	1,3-Di-chloro-benzene	1,2-Di-chloro-benzene	Total Methylene Chloride	VOA	Chloride	Acetone	2-Hexanone	4-Methyl-2-Pentanone				
WP1-1A *	<1	<1	<1	<1	<1	<1	<1	<1	41	1	<1	<1	<1	<1	<1	13 J	<1	<1	<1	<1	<1	55 J	NA	NA	NA	NA	NA	NA	NA	NA					
WP1-2	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	NA	NA	NA	NA	NA	NA	NA	NA					
WP1-2 Duplicate	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	NA	NA	NA	NA	NA	NA	NA	NA					
WP1-3	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	NA	NA	NA	NA	NA	NA	NA	NA					
WP1-4(H)	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	NA	NA	NA	NA	NA	NA	NA	NA					
WP1-5	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	NA	NA	NA	NA	NA	NA	NA	NA					
WP1-6	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	NA	NA	NA	NA	NA	NA	NA	NA					
WP2-1 **	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	7 J	5 J	<1	<1	<1	19 J	NA	NA	NA	NA	NA	NA	NA	NA					
WP2-2 **	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	160 J	<1	<1	<1	<1	<1	160 J	NA	NA	NA	NA	NA	NA	NA	NA				
WP2-6 *	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	2	NA	NA	NA	NA	NA	NA	NA	NA				
WP2-9 *	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	NA	NA	NA	NA	NA	NA	NA	NA	NA				
WP2-10 *	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	8 J	NA	NA	NA	NA	NA	NA	NA	NA				
WP3E-1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	NA	NA	NA	NA	NA	NA	NA	NA	NA				
WP3E-2	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	NA	NA	NA	NA	NA	NA	NA	NA	NA				
WP3E-3	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	NA	NA	NA	NA	NA	NA	NA	NA	NA				
WP3E-4	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	NA	NA	NA	NA	NA	NA	NA	NA	NA				
WP3E-5	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	NA	NA	NA	NA	NA	NA	NA	NA	NA				
WP3E-6 *	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	25	17	2	4 J	7 J	<1	NA	NA	NA	NA	NA	NA	NA	NA	NA				
(1) WP3E-6	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	35	13	2	2 J	17	<1	67 J	8	2500 J	9 J	73	NA	NA	NA	NA	NA			
WP3E-7	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	NA	NA	NA	NA	NA	NA	NA	NA	NA				
WP3E-8(H)	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	NA	NA	NA	NA	NA	NA	NA	NA	NA				
WP3E-8 Duplicate	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	3 J	NA	NA	NA	NA	NA	NA	NA	NA				
WP3E-9	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	2	<1	1 J	<1	<1	<1	NA	NA	NA	NA	NA	NA	NA	NA	NA				
WP3W-1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	NA	NA	NA	NA	NA	NA	NA	NA	NA				
WP3W-2	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	NA	NA	NA	NA	NA	NA	NA	NA	NA				
WP3W-3	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	NA	NA	NA	NA	NA	NA	NA	NA	NA				
WP3W-4	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	NA	NA	NA	NA	NA	NA	NA	NA	NA				
WP4-1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	3	<1	4 J	26	<1	NA	NA	NA	NA	NA	NA	NA	NA					
WP4-2	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	2 J	<1	<1	<1	<1	2 J	NA	NA	NA	NA	NA	NA	NA	NA	NA			
WP4-3	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	1	<1	<1	<1	<1	4	NA	NA	NA	NA	NA	NA	NA	NA	NA			
WP4-3 Duplicate	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	5	3	1	<1	48	<1	<1	<1	56	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 5-2 (Continued)

Location	EPA METHOD 601						EPA METHOD 602						EPA METHOD 624							
	1,1-Di-chloro-methane	1,1,1-Trichloro-ethane	Vinyl chloride	trans-1,2-Dichloro-ethene	1,3-Di-chloro-benzene	Chloro-benzene	Chloro-benzene	Ethyl benzene	Benzene	Toluene	benzene	benzene	1,3-Di-chloro-benzenes	1,2-Di-chloro-benzenes	1,4-Di-chloro-benzenes	Total Methylene VOA	Total Chloride	Total Acetone	Total 2-Hexanone	Total 2-Pentanone
WP5-1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
WP5-2	1 J	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
WP5-3	<1	<1	<1	<1	<1	<1	<1	<1	60	1	<1	19 J	1	<1	<1	<1	81 J	NA	NA	NA
WP6-1	1 J	<1	1 J	<1	<1	<1	<1	<1	<1	<1	<1	6 J	1	<1	<1	<1	7 J	NA	NA	NA
WP6-2	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	>1	>1	<1	<1	<1	<1	NA	NA	NA
WP6-3	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	>1	>1	<1	<1	<1	<1	NA	NA	NA
WP7-1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	NA	NA	NA
WP7-3	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	NA	NA	NA
WP7-4	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	NA	NA	NA
WP7-6	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	NA	NA	NA
WP7-7	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	NA	NA	NA
WP8-1	<1	<1	<1	<1	35 J	6 J	17 J	7	2	35	12 J	28	6	17 X	<1	49 J	NA	NA	NA	NA
WP8-2	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	NA	NA	NA	NA
WP8-2 Duplicate	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	NA	NA	NA
WP8-3	<1	<1	<1	1 & J	2 J	9 J	4 J	34 J	26	39	9	150 J	430	<1	34 X	<1	645 J	NA	NA	NA
WP8-4	<1	<1	<1	<1	<1	2 J	<1	3	<1	<1	55	2	2 X	<1	58	NA	NA	NA	NA	NA
Blanks (ug/l)																				
Equipment Blank	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	NA	NA	NA
Equipment Blank *	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	NA	NA	NA
Field Blank	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	NA	NA	NA
Field Blank *	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	NA	NA	NA
Travel Blank	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	NA	NA	NA
Travel Blank *	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	NA	NA	NA
Travel Blank **	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	NA	NA	NA
Method Blank	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<10	<5	<10

## Notes:

J = Estimated. Analyte Was Present But The Reported Value May Not Be Accurate Or Precise.

NA = Analyte Not Analyzed.

\* = Samples And Blanks Collected 6/15/89, All Others 6/9/89.

\*\* = Samples And Blanks Collected 6/13/89, All Others 6/9/89.

&amp; = Combined Vinyl Chloride And Dichlorodifluoromethane (Used Packed Column Instead Of Capillary Column To Meet Holding Time).

X = Combined 1,2 &amp; 1,4 Dichlorobenzene (Used Packed Column Instead Of Capillary Column To Meet Holding Time).

(1) - Analysis By EPA Method 624.

M = Total 1,2-Dichloroethene.

A = FDER Guidance Concentration.

B = Florida Drinking Water Standard.

H = Missed Holding Time

Total VOA Defined by FAC 17-70 As Total Of Benzene, Toluene, Xylene, And Ethyl Benzene.

Table 5-3  
 SUMMARY OF GROUNDWATER SAMPLE ANALYSES FOR  
 SEMIVOLATILES, POLYNUCLEAR AROMATICS, AND EDB (ug/l)  
 FIRST STEP OF THE SI  
 125TH FIGHTER INTERCEPTOR GROUP, FLORIDA AIR NATIONAL GUARD  
 JACKSONVILLE, FLORIDA

FI Criteria	Location	EPA METHOD 610						EPA METHOD 625					
		Naphthalene	2-Methyl-naphthalene	1-Methyl-naphthalene	benzene	1,3-Dichloro-benzene	1,4-Dichloro-benzene	4-Methyl-phenol	Benzoic Acid	Naphthalene	2-Methyl-naphthalene	Bis(2-ethyl-hexyl)phthalate	EDB
WP1-1A *	10 A	10 A	10 A	10 A	75 C	10 A	10 A	NA	NA	NA	NA	NA	0.02 A
WP1-2	NA	NA	<2	<2	NA	NA	NA	NA	NA	NA	NA	NA	NA
WP1-3 *	NA	<5	<5	<5	NA	<10	<10	<50	<10	<10	4 BJ	<0.02	NA
WP1-4 *	NA	<2	<2	<2	NA	NA	NA	NA	NA	NA	NA	NA	NA
WP1-5 *	NA	<2	<2	<2	NA	NA	NA	NA	NA	NA	NA	NA	NA
WP1-6 *	NA	<2	<2	<2	NA	NA	NA	NA	NA	NA	NA	NA	NA
WP3E-1	NA	<2	<2	<2	NA	NA	NA	NA	NA	NA	NA	NA	NA
WP3E-2	NA	<2	<2	<2	NA	NA	NA	NA	NA	NA	NA	NA	NA
WP3E-3	NA	<2	<2	<2	NA	NA	NA	NA	NA	NA	NA	NA	NA
WP3E-4	NA	<2	<2	<2	NA	NA	NA	NA	NA	NA	NA	NA	NA
WP3E-5	NA	<2	<2	<2	NA	NA	NA	NA	NA	NA	NA	NA	NA
WP3E-6	NA	NA	NA	NA	<10	<10	<10	<50	<10	<10	3 BJ	<0.02	NA
WP3E-8	NA	<2	<2	<2	NA	NA	NA	NA	NA	NA	NA	NA	NA
WP3E-8 Duplicate	NA	<2	<2	<2	NA	NA	NA	NA	NA	NA	NA	NA	NA
WP3E-9	NA	<2	<2	<2	NA	NA	NA	NA	NA	NA	NA	NA	NA
WP3W-1	NA	<2	<2	<2	NA	NA	NA	NA	NA	NA	NA	NA	NA
WP3W-2	NA	<2	<2	<2	NA	NA	NA	NA	NA	NA	NA	NA	NA
WP3W-3	NA	<2	<2	<2	NA	NA	NA	NA	NA	NA	NA	NA	NA
WP3W-4	NA	<2	<2	<2	NA	NA	NA	NA	NA	NA	NA	NA	NA
WP4-1	NA	NA	NA	<40	<40	210	1300 J	<40	<40	<40	<40	<0.02	NA
WP4-2 *	NA	<2	<2	<2	NA	NA	NA	NA	NA	NA	NA	NA	NA
WP4-3 *	NA	<5	<5	<5	NA	NA	NA	NA	NA	NA	NA	NA	NA
WP4-3 Duplicate *	NA	<5	<5	<5	NA	NA	NA	NA	NA	NA	NA	NA	NA
WP5-3 *	NA	<5	<2	<2	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 5-3 (Continued)

Location	EPA METHOD 610						EPA METHOD 625					
	Naphthalene	2-Methyl-naphthalene	1-Methyl-naphthalene	1,3-Dichloro-benzene	1,4-Dichloro-benzene	4-Methyl-phenol	Benzoic Acid	Naphthalene naphthalene	2-Methyl-hexyl)phthalate	Bis(2-ethyl-hexyl)phthalate	EDB	
WP7-1	<2	<2	<2	NA	NA	NA	NA	NA	NA	NA	NA	
WP7-3	<2	<2	<2	NA	NA	NA	NA	NA	NA	NA	NA	
WP7-4	<2	<2	<2	NA	NA	NA	NA	NA	NA	NA	NA	
WP7-6	<2	<2	<2	NA	NA	NA	NA	NA	NA	NA	NA	
WP7-7	<2	<2	<2	NA	NA	NA	NA	NA	NA	NA	NA	
WP8-1	NA	NA	4 J	7 J	4 J	<50	26	44	6 BJ	<0.02		
WP8-2 *	<2	<2	<2	NA	NA	NA	NA	NA	NA	NA	NA	
WP8-2 Duplicate *	<2	<2	<2	NA	NA	NA	NA	NA	NA	NA	NA	
WP8-3 *	89	45	28	NA	NA	NA	NA	NA	NA	NA	NA	
WP8-4 *	<2	<2	<2	NA	NA	NA	NA	NA	NA	NA	NA	
(Blanks ug/l)												
Field	<2	<2	<2	<10	<10	<50	<10	<10	<10	<10	5 BJ	<0.02
Equipment	<2	<2	<2	<10	<10	<50	<10	<10	<10	<10	3 BJ	<0.02
Travel	<2	<2	<2	<10	<10	<50	<10	<10	<10	<10	<10	<0.02
Method	<2	<2	<2	<10	<10	<50	<10	<10	<10	<10	3 BJ	<0.02
Field *	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Equipment *	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Travel *	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Method *	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2

Notes:

B = Analyte Was Not Detected Above Ten Times The Value Reported In The Laboratory Blank.

&lt; = Analyte Was Analyzed For But Not Detected Above The Reported Value.

J = Estimated. Analyte Was Present But The Reported Value May Not Be Accurate Or Precise.

\* = Samples Collected 5/15/89, All Others 6/13/89.

NA = Not Analyzed.

A = FDER Guidance Concentration.

C = Florida Drinking Water Standard.

**Table 5-4**  
**SUMMARY OF GROUNDWATER SAMPLE ANALYSES FOR**  
**METALS, TOC, AND TSS (ug/l)**  
**FIRST STEP OF THE SI**  
**125TH FIGHTER INTERCEPTOR GROUP, FLORIDA AIR NATIONAL GUARD**  
**JACKSONVILLE, FLORIDA**

Location	As	Ba	Cd	Cr	Pb	Hg	Se	Ag	TOC	TSS
Fl Criteria	50 A	1000 A	10 A	50 A	50 A	2 A	10 A	50 A		
WP1-1A *	2.8 J	NA	NA	NA	54.1 J	NA	1.4 J	NA	NA	NA
WP1-2	7.2 J	342	4.5 J	99.3	66.3	0.2 J	0.94 J	<4.4	95800	NA
WP1-2 Duplicate	9.2 J	378	3.4 J	116	67.2	0.2 J	<0.85	<4.4	NA	NA
WP1-3	NA	NA	NA	NA	4 B	NA	NA	NA	NA	NA
WP1-4	NA	NA	NA	NA	34.4	NA	NA	NA	NA	NA
WP1-5	NA	NA	NA	NA	4.4 B	NA	NA	NA	NA	NA
WP1-6	NA	NA	NA	NA	5.8	NA	NA	NA	NA	429000
WP2-6 *	NA	NA	NA	NA	1200 J	NA	NA	NA	NA	NA
WP2-9 *	NA	NA	NA	NA	1100 J	NA	NA	NA	NA	NA
WP2-10 *	NA	NA	NA	NA	640 J	NA	NA	NA	NA	NA
WP3E-1	NA	NA	NA	NA	26.8	NA	NA	NA	NA	NA
WP3E-2	NA	NA	NA	NA	6.8	NA	NA	NA	NA	NA
WP3E-3	NA	NA	NA	NA	2.6 B	NA	NA	NA	NA	NA
WP3E-4	NA	NA	NA	NA	9.5	NA	NA	NA	NA	NA
WP3E-5	NA	NA	NA	NA	4.2 B	NA	NA	NA	NA	NA
WP3E-6 *	6 J	574	<1.7	46 M	31.2 J	0.41 L	1.5 J	<4.4	374000	248000
WP3E-8	NA	NA	NA	NA	3.9 B	NA	NA	NA	NA	NA
WP3E-8 Duplicate	NA	NA	NA	NA	6.4	NA	NA	NA	NA	NA
WP3E-9	NA	NA	NA	NA	6.7	NA	NA	NA	NA	NA
WP3W-1	NA	NA	NA	NA	5.7	NA	NA	NA	NA	NA
WP3W-2	NA	NA	NA	NA	6.8	NA	NA	NA	NA	NA
WP3W-3	NA	NA	NA	NA	4 B	NA	NA	NA	NA	674000
WP3W-4	NA	NA	NA	NA	29.3	NA	NA	NA	NA	NA
WP4-1	5.2 J	34.1 J	3.1 J	25.7	10.7	0.2 J	<0.85	<4.4	306000	NA
WP4-2	NA	NA	NA	NA	3.8	NA	NA	NA	NA	424000
WP4-3	NA	NA	NA	NA	18.5	NA	NA	NA	NA	NA
WP4-3 Duplicate	NA	NA	NA	NA	16.4	NA	NA	NA	NA	NA
WP5-3	2.7 J	48 J	4 J	7.7 J	2.2 B	0.16 J	<0.85	<4.4	NA	NA
WP6-1	1 J	216	<1.7	113	32.4	0.53 J	<0.85	<4.4	NA	NA
WP6-2	<0.68	121 J	<1.7	56.8	12.4	0.41 J	<0.85	<4.4	NA	NA
WP6-3	<0.68	245	<1.7	115	21.2	0.45 J	<0.85	<4.4	NA	NA
WP7-1	NA	NA	NA	NA	5.9	NA	NA	NA	NA	NA
WP7-3	NA	NA	NA	NA	4.9 J	NA	NA	NA	NA	NA
WP7-4	NA	NA	NA	NA	5.4	NA	NA	NA	NA	NA
WP7-6	NA	NA	NA	NA	7.9	NA	NA	NA	NA	NA
WP7-7	NA	NA	NA	NA	10.6	NA	NA	NA	NA	NA
WP8-1	3 J	334	3.8 J	7.5 J	5.9	0.49 J	<0.85	<4.4	93200	NA
WP8-2	NA	NA	NA	NA	14.6	NA	NA	NA	NA	NA
WP8-2 Duplicate	NA	NA	NA	NA	26.5	NA	NA	NA	NA	NA
WP8-3	NA	NA	NA	NA	1.9 B	NA	NA	NA	NA	451000

Table 5-4 (Continued)

Location	As	Ba	Cd	Cr	Pb	Hg	Se	Ag	TOC	TSS
WP8-4	NA	NA	NA	NA	5.4	NA	NA	NA	NA	NA
(Blanks)										
Equipment Blank 1	<0.68	3.4 B	<1.7	<3.2	2.7 B	<0.15	<0.85	<4.4	<1000	NA
Equipment Blank 2	NA	NA	NA	NA	2 B	NA	NA	NA	NA	NA
Equipment Blank 3 *	NA	NA	NA	NA	3.9	NA	NA	NA	NA	NA
Field Blank 1	<0.68	4.4 B	<1.7	<3.2	0.58 B	<0.15	<0.85	<4.4	<1000	NA
Field Blank 2	NA	NA	NA	NA	0.93 B	NA	NA	NA	NA	NA
Field Blank 3 *	NA	NA	NA	NA	4.4	NA	NA	NA	NA	NA
Travel Blank 1	<0.68	2.1 B	<1.7	<3.2	3 B	<0.15	<0.85	<4.4	<1000	NA
Travel Blank 2	NA	NA	NA	NA	1.1 B	NA	NA	NA	NA	NA
Travel Blank 3 *	NA	NA	NA	NA	2 B	NA	NA	NA	NA	NA
Method Blank									<1000	<4000

## Notes:

B = Analyte Was Not Detected Above Five Times The Value Reported In The Laboratory Blank.

NA = Analyte Was Not Analyzed.

M = Duplicate Precision Was Not Met. It Is Not Possible To Determine Whether The Resulting Bias Is High Or Low.

&lt; = Analyte Was Analyzed For But Not Detected Above The Reported Value.

J = Estimated. Analyte Was Present But The Reported Value May Not Be Accurate Or Precise.

L = Analyte Was Present But The Reported Value May Be Biased Low; The Actual Value Is Expected To Be Higher.

\* = Samples Collected 6/15/89, All Others 6/9/89.

A = Florida Drinking Water Standard.

**Table 5-5**  
**SUMMARY OF SOIL SAMPLE ANALYSES FOR**  
**POLYNUCLEAR AROMATICS AND VOLATILES (ug/kg)**  
**FIRST STEP OF THE SI**  
**125TH FIGHTER INTERCEPTOR GROUP, FLORIDA AIR NATIONAL GUARD**  
**JACKSONVILLE, FLORIDA**

Location	Depth (ft)	Total PNAs	Total 8010s	Total 8020s *	Total Xylenes
WP1-1	0.5-1.0	ND	ND	ND	ND
WP1-1 Duplicate	0.5-1.0	ND	ND	ND	ND
WP1-2	3.5-4.0	ND	ND	ND	ND
WP1-3	2.0-2.5	NA	ND	ND	ND
WP1-4	2.5-3.0	ND	ND	ND	ND
WP3E-1	3.5-4.0	ND	ND	ND	ND
WP3E-6	1.5-2.0	ND	ND	ND	ND
WP3E-6	3.5-4.0	ND	ND	ND	ND
WP3E-7	3.5-4.0	ND	ND	ND	ND
WP3W-1	4.0-4.5	ND	ND	ND	ND
WP3W-5	3.5-4.0	ND	ND	ND	ND
WP4-1	1.0-1.5	NA	ND	ND	ND
WP4-1 Duplicate	1.0-1.5	NA	ND	ND	ND
WP4-1	3.0-3.5	ND	ND	ND	ND
WP4-2	2.5-3.0	ND	ND	ND	ND
WP4-3	0.5-1.0	ND	ND	ND	600
WP5-2	2.0-2.5	ND	ND	ND	ND
WP5-3	1.0-1.5	ND	ND	ND	ND
WP5-3	4.0-4.5	ND	ND	ND	ND
WP6-1	4.5-5.0	NA	ND	ND	ND
WP6-2	4.5-5.0	NA	ND	ND	ND
WP7-2	3.5-4.0	ND	ND	ND	ND
WP7-5	3.5-4.0	ND	ND	ND	ND
WP8-1	2.0-2.5	NA	ND	ND	ND
WP8-3	2.5-3.0	ND	ND	ND	ND
WP8-4	2.5-3.0	ND	ND	ND	ND
WP8-4 Duplicate	2.5-3.0	ND	ND	ND	ND
(Blanks)					
Method Blank		ND	ND	ND	ND

Notes:

ND = Analytes Analyzed For But Not Detected.

NA = Analyte Was Not Analyzed.

\* = Except For Total Xylenes.

**Table 5-6**  
**SUMMARY OF SOIL SAMPLE ANALYSES FOR**  
**TOC, EDB, PCBs, AND SEMIVOLATILES (ug/kg)**  
**FIRST STEP OF THE SI**  
**125TH FIGHTER INTERCEPTOR GROUP, FLORIDA AIR NATIONAL GUARD**  
**JACKSONVILLE, FLORIDA**

Location	Depth (ft)	TOC	EDB	Total PCBs	Bis(2-ethylhexyl) phthalate
WP1-3	2.0-2.5	10200000	<0.2	NA	140 B
WP3E-6	1.5-2.0	NA	NA	ND	NA
WP3E-6	3.5-4.0	NA	NA	ND	NA
WP4-1	1.0-1.5	12000000	<0.2	NA	37 B
WP4-1 Duplicate	1.0-1.5	6520000	<0.2	NA	<350
WP5-2	2.0-2.5	NA	NA	ND	NA
WP5-3	1.0-1.5	NA	NA	ND	NA
WP5-3	4.0-4.5	NA	NA	ND	NA
WP8-1	2.0-2.5	2110000	<0.2	NA	77 B
(Blanks)					
Method Blank		<1000	<0.2	ND	37 B

**Notes:**

**B = Analyte Was Not Detected Above Ten Times The Value Reported In The Laboratory Blank.**

**NA = Analyte Was Not Analyzed.**

**ND = Not Detected.**

**< = Analyte Was Analyzed For But Not Detected Above The Reported Value.**

**Table 5-7**  
**SUMMARY OF SOIL SAMPLE ANALYSES FOR**  
**METALS (ug/kg)**  
**FIRST STEP OF THE SI**  
**125TH FIGHTER INTERCEPTOR GROUP, FLORIDA AIR NATIONAL GUARD**  
**JACKSONVILLE, FLORIDA**

Location	Depth (ft)	As	Ba	Cd	Cr	Pb	Hg	Se	Ag
WP1-1	0.5-1.0	NA	NA	NA	NA	4300 K	NA	NA	NA
WP1-1 Duplicate	0.5-1.0	NA	NA	NA	NA	4400 K	NA	NA	NA
WP1-2	3.5-4.0	NA	NA	NA	NA	4100 K	NA	NA	NA
WP1-3	2.0-2.5	950 J	5900 J	<210	1400	4700 K	<19	<110	<550
WP1-4	2.5-3.0	NA	NA	NA	NA	2000 K	NA	NA	NA
WP3E-1	3.5-4.0	NA	NA	NA	NA	9000 K	NA	NA	NA
WP3E-6	1.5-2.0	NA	NA	NA	NA	2800 K	NA	NA	NA
WP3E-6	3.5-4.0	NA	NA	NA	NA	2100 K	NA	NA	NA
WP3E-7	3.5-4.0	NA	NA	NA	NA	4000 K	NA	NA	NA
WP3W-1	4.0-4.5	NA	NA	NA	NA	5300 K	NA	NA	NA
WP3W-5	3.5-4.0	NA	NA	NA	NA	5400 K	NA	NA	NA
WP4-1	1.0-1.5	180 J	3200 J	<190	2300	3500 K	<17	220 J	<490
WP4-1 Duplicate	1.0-1.5	1200 K	4200 J	<190	3000	3200 K	<17	170 J	<490
WP4-1	3.0-3.5	NA	NA	NA	NA	2500 K	NA	NA	NA
WP4-2	2.5-3.0	NA	NA	NA	NA	2700 K	NA	NA	NA
WP4-3	0.5-1.0	NA	NA	NA	NA	5800 K	NA	NA	NA
WP5-2	2.0-2.5	220 J	2800 J	<210	4700	2800 K	<19	<110	<550
WP5-3	1.0-1.5	1000 J	4100 J	620	4900	4300 K	<17	130 J	<490
WP5-3	4.0-4.5	350 J	3400 J	<210	2700	3300 K	<19	330 J	<550
WP6-1	4.5-5.0	330 J	4700 J	<210	2700	800 K	<19	190 J	<550
WP6-2	4.5-5.0	280 J	5300 J	<210	2800	1600 K	<19	120 J	<550
WP7-2	3.5-4.0	NA	NA	NA	NA	8100 K	NA	NA	NA
WP7-5	3.5-4.0	NA	NA	NA	NA	3200 K	NA	NA	NA
WP8-1	2.0-2.5	1100 J	51900	<210	8600	7600 K	<19	<110	<550
WP8-3	2.5-3.0	NA	NA	NA	NA	14700 K	NA	NA	NA
WP8-4	2.5-3.0	NA	NA	NA	NA	4600 K	NA	NA	NA
WP8-4 Duplicate	2.5-3.0	NA	NA	NA	NA	2400 K	NA	NA	NA
Background *	1.0-2.0	140	3100	< 190	1800	3400	< 86	< 130	< 800

Notes:

J = Estimated. Analyte Was Present But The Reported Value May Not Be Accurate Or Precise.

K = Analyte Was Present But The Reported Value May Be Biased High; The Actual Value Is Expected To Be Lower.

NA = Analyte Was Not Analyzed.

< = Analyte Was Analyzed For But Not Detected Above The Reported Value.

\* = Background Soil Sample Collected 11/28/89 During Second Step Of SI.

Table 5-8  
 SUMMARY OF SEDIMENT AND SURFACE WATER  
 SAMPLE ANALYSES FOR VOLATILES  
 FIRST STEP OF THE SI  
 125TH FIGHTER INTERCEPTOR GROUP, FLORIDA AIR NATIONAL GUARD  
 JACKSONVILLE, FLORIDA

Location	Trichloro-fluoro-methane	Methylene Chloride	Chloroform	Tert-Butyl Methyl Ether	Benzene	Toluene	Ethyl Benzene	Total Xylenes	Total VOA (I)	1,4-Di-chlorobenzene	1,2-Di-chlorobenzene	Bromo-methane
<b>Sediment (ug/kg)</b>												
R1U	400 J	<500	<100	<100	<100	<100	<100	<100	<400	<100	<100	<100
R1C	600 J	<500	<100	<100	<100	<100	<100	<100	<400	<100	<100	<100
R1D	400 J	<500	<100	<100	<100	<100	<100	200	200	<100	<100	<100
1 C.O. *	<100	<500	<100	<100	<100	<100	<100	<100	<400	<100	<100	<100
1 M.O. *	<100	<500	<100	<100	<100	<100	<100	<100	<400	<100	<100	<100
R2U	<100	<500	<100	<100	<100	<100	<100	<100	<400	<100	<100	<100
R2C	<100	<500	<100	<100	<100	<100	<100	<100	<400	<100	<100	<100
R2D	<100	<500	<100	<100	<100	<100	<100	<100	<400	<100	<100	<100
R3U	<100	<500	<100	<100	<100	<100	<100	800	800	<100	<100	<100
R3C	<100	<500	<100	<100	<100	<100	<100	<100	<400	<100	<100	<100
R3D	<100	<500	<100	<100	<100	<100	<100	<100	<400	<100	<100	<100
R4U	<100	<500	<100	<100	<100	<100	<100	<100		100 J	<100	100
R4C	<100	<500	<100	<1000	<1000	<1000	1000	6000	7000	<100	<100	<100
R4C Duplicate	<100	<500	<100	<1000	<1000	1000	<1000	7000	8000	200 J	800 J	300
R4D	<100	<500	<100	<100	<100	<100	<100	<100	<400	<100	<100	<100
R4D Duplicate	400 J	<500	<100	<100	<100	<100	<100	<100	<400	<100	<100	<100
4 OWS	400 J	<500	<100	<100	<100	<100	<100	300	300	<100	<100	<100
<b>Water (ug/l)</b>												
R1C	<1	<5	<1	<1	<1	<1	<1	<1	<4	<1	<1	<1
R2C	<1	<5	<1	<1	<1	<1	<1	<1	<4	<1	<1	<1
R3C	<1	7 J	<1	<1	<1	<1	<1	<1	<4	<1	<1	<1
R4C	<10	430 J	29 J	79 J	470 J	1600 J	100 J	650 J	2820 J	<1	<1	<1
R4C Duplicate	<10	450 J	30 J	120 J	450 J	1170 J	180 J	720 J	2520 J	<1	<1	<1
4 OWS	<1	<5	<1	1 J	4 J	7 N	6 J	17 J	34 JN	<1	<1	<1
<b>Blanks (ug/l)</b>												
Trip	<1	<5	<1	<1	<1	<1	<1	<1	<4	<1	<1	<1
Rinse	<1	<5	<1	<1	<1	<1	<1	<1	<4	<1	<1	<1
Method	<1	<5	<1	<1	<1	1 J	<1	<1	1 J	<1	<1	<1

Notes:

J = Estimated. Analyte Was Present But The Reported Value May Not Be Accurate Or Precise.

N = Analyte Was Not Detected Above 5 Times The Value Reported In The Laboratory Blank.

< = Analyte Was Analyzed For But Not Detected Above The Reported Value.

(I) = Total VOA Defined by FAC 17-70 As Total Of Benzene, Toluene, Xylene, and Ethyl Benzene.

Total VOA Calculated Only For Samples With Detectable Concentrations.

\* = 1 C.O. And 1 M.O. Were Sediment Samples Collected On A Drainage Feature Leading From The OWS Inlet

On The West Side Of Site 1. 1 C.O. Was Collected At The Inlet Structure Overflow and 1 M.O. Was Collected

Midway Between The Inlet And Reach 3 (See Attachment 1 For Locations)

Table 5-9  
 SUMMARY OF SEDIMENT AND SURFACE WATER  
 SAMPLE ANALYSES FOR SEMIVOLATILES, EDB, AND PCB  
 FIRST STEP OF THE SI  
 125TH FIGHTER INTERCEPTOR GROUP, FLORIDA AIR NATIONAL GUARD  
 JACKSONVILLE, FLORIDA

Location	Phenanthrene	Anthracene	Fluoranthene	Benz(a)-anthracene	Bis(2-ethylhexyl)phthalate	Chrysene	Benz(a)pyranthene	Benz(a)pyrene	Indeno(1,2,3-cd)Pyrene	Benzof(g,h)-naphthalene	Indeno(1,2,3-cd)Pyrene	2-Methyl-naphthalene	Phenol	EDB	Total PCBs	
<b>Sediment (ug/kg)</b>																
R1U	<600	<600	<600	<600	<600	<600	<600	<600	<600	<600	<600	<600	<600	<600	ND	
RIC	<560	<560	<560	<560	<560	<560	<560	<560	<560	<560	<560	<560	<560	<560	<0.3	
RID	<460	<460	<460	<460	<460	<460	<460	<460	<460	<460	<460	<460	<460	<460	ND	
I.C.O.	<410	<410	<410	<410	<410	<410	<410	<410	<410	<410	<410	<410	<410	<410	NA	
I.M.O.	<430	<430	<430	<430	<430	<430	<430	<430	<430	<430	<430	<430	<430	<430	NA	
R2U	<520	<520	<520	<520	<520	<520	<520	<520	<520	<520	<520	<520	<520	<520	NA	
R2C	<800	<800	<800	<800	<800	<800	<800	<800	<800	<800	<800	<800	<800	<800	<0.4	
R2D	<750	<750	<750	<750	<750	<750	<750	<750	<750	<750	<750	<750	<750	<750	NA	
R3U	<410	<410	<410	<410	<410	<410	<410	<410	<410	<410	<410	<410	<410	<410	NA	
R3C	<5300	<5300	<5300	<5300	<5300	<5300	<5300	<5300	<5300	<5300	<5300	<5300	<5300	<5300	<0.3	
R3D	<470	<470	<470	<470	<470	<470	<470	<470	<470	<470	<470	<470	<470	<470	NA	
R4U	11000	480 J	24000	18000	60000	13000	3500	10000	16000	11000	8500	9100	1600 J	<2600	NA	
R4C	<5200	<5200	<5200	<5200	<5200	<5200	<5200	<5200	<5200	<5200	<5200	<5200	<5200	<5200	<0.4	
R4C Duplicate	<2400	<2400	<2400	<2400	<2400	<2400	<2400	<2400	<2400	<2400	<2400	<2400	<2400	<2400	<0.3	
R4D	<430	<430	<430	<430	<430	<430	<430	<430	<430	<430	<430	<430	<430	<430	NA	
4 OWS	<590	<590	<590	<590	<590	<590	<590	<590	<590	<590	<590	<590	<590	<590	NA	
Method Blank	<330	<330	<330	<330	<330	<330	<330	<330	<330	<330	<330	<330	<330	<330	<0.2	
<b>Water (ug/l)</b>																
* FI Criteria																
RIC	<10	<10	<10	<10	<10	<10	6 BJ	<10	<10	<10	<10	<10	<10	<10	<0.01	
R2C	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<0.02	
R3C	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<0.02	
R4C	<10	<10	<10	<10	<10	<10	13 B	<10	<10	<10	<10	<10	<10	<10	<0.05	
R4C Duplicate	<200	<200	<200	<200	<200	<200	<200	<200	<200	<200	<200	<200	<200	<200	NA	
4 OWS	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<0.02	
Blanks (ug/l)																
Rinse	<10	<10	<10	<10	<10	<10	10 B	<10	<10	<10	<10	<10	<10	<10	<0.02	
Trip	<10	<10	<10	<10	<10	<10	6 BJ	<10	<10	<10	<10	<10	<10	<10	<0.02	
Method	<10	<10	<10	<10	<10	<10	8 J	<10	<10	<10	<10	<10	<10	<10	<0.02	

Notes:

B = Analyte Was Not Detected Above Five Times The Value Reported In The Laboratory Blank.

J = Estimated. Analyte Was Present But The Reported Value May Not Be Accurate Or Precise.

NA = Analyte Was Not Analyzed.

< = Analyte Was Analyzed But Not Detected Above The Reported Value.

ND = Analytes Were Analyzed For But Not Detected.

\* = FAC 17-3 Water Quality Criteria For Class III Surface Waters.

**Table 5-10**  
**SUMMARY OF SEDIMENT AND**  
**SURFACE WATER SAMPLE ANALYSES FOR METALS**  
**FIRST STEP OF THE SI**  
**125TH FIGHTER INTERCEPTOR GROUP, FLORIDA AIR NATIONAL GUARD**  
**JACKSONVILLE, FLORIDA**

Location	As	Ba	Cd	Cr	Pb	Hg	Se	Ag
<b>Sediment (ug/kg)</b>								
R1U	NA	NA	NA	NA	8700 L	NA	NA	NA
R1C	1500 J	36200	530 J	7800 L	9200 L	130 J	160 J	<730
R1D	NA	NA	NA	NA	6600 L	NA	NA	NA
<b>1 C.O.</b>	NA	NA	NA	NA	8700 L	NA	NA	NA
<b>1 M.O.</b>	2200	2300 J	410 J	1300 L	4400 L	NA	<110	<550
R2U	NA	NA	NA	NA	5300 L	NA	NA	NA
R2C	630 J	16500 J	370 J	7500 L	5900 L	<130	<140	<730
R2D	NA	NA	NA	NA	8500 L	NA	NA	NA
R3U	NA	NA	NA	NA	9400 L	NA	NA	NA
R3C	3300	50400	3600	71200 L	37400 L	<200	<210	<1100
R3D	NA	NA	NA	NA	5700 L	NA	NA	NA
R4U	NA	NA	NA	NA	364000 L	NA	NA	NA
R4C	490 J	22000 J	7400	80400 L	246000 L	<150	<170	<880
R4C Duplicate	480 J	29800	13200	119000 L	152000 L	<110	<120	<630
R4D	NA	NA	NA	NA	4700 L	NA	NA	NA
R4D Duplicate	NA	NA	NA	NA	5500 L	NA	NA	NA
<b>4 OWS</b>	NA	NA	NA	NA	6000 L	NA	NA	NA
<b>Background #</b>	870	9100	< 220	4600	18600	< 100	170	< 930
<b>Water (ug/l)</b>								
* FL Criteria	50		0.8 - 1.2	50	30	0.2	25	.07
R1C	0.78 B	40 J	<1.7	3.4 J	4.2	0.68	<0.85	4.7 J
R2C	4.3 J	145 J	9.3	63.4	28.1	<0.15	<0.85	<4.4
R3C	<0.68	46.4 J	<1.7	<3.2	11	<0.15	<0.85	<4.4
R4C	<0.68	48.2 J	21.7	122	41.9	<0.15	<0.85	<4.4
R4C Duplicate	<0.68	22.6 J	12.8	58.9	41.1	<0.15	1.1 J	<4.4
4 OWS	<0.68	12.7 J	<1.7	<3.2	7.2	<0.15	<0.85	19.1
<b>Blanks (ug/l)</b>	<0.68							
Rinse	<0.68	1.6 J	<1.7	<3.2	6.9	0.6	<0.85	<4.4
Trip	<0.68	<0.9	<1.7	<3.2	4.5	<0.15	<0.85	<4.4

**Notes:**

J = Estimated. Analyte Was Present But The Reported Value May Not Be Accurate Or Precise.

L = Analyte Was Present But The Reported Value May Be Biased Low; The Actual Value Is Expected To Be Higher.

B = Analyte Was Not Detected Above 5 Times The Value Reported In The Laboratory Blank.

NA = Analyte Was Not Analyzed.

< = Analyte Was Analyzed For But Not Detected Above The Reported Value.

# = Background Sediment Sample Collected 11/28/89 During Step 2 SI.

\* = FAC 17-3 Water Quality Criteria For Class III Surface Waters.

**Table 5-11**  
**RESULTS OF SOIL ORGANIC VAPOR HEADSPACE ANALYSES**  
**(SECOND STEP OF THE SI)**  
**125TH FIGHTER INTERCEPTOR GROUP,**  
**FLORIDA AIR NATIONAL GUARD, JACKSONVILLE, FLORIDA**

Location	Depth (ft)	OVA Reading with Filter (ppm)	OVA Reading without Filter (ppm)
WP 1-2	2.0 - 2.5	120	120
WP 2-7	4.0 - 4.5	110	50
WP 4-2	2.0 - 2.5	130	130

**Table 5-12**  
**SUMMARY OF GROUNDWATER SAMPLE ANALYSES FOR VOLATILES (ug/l)**  
**SECOND STEP OF THE SI**  
**125TH FIGHTER INTERCEPTOR GROUP, FLORIDA AIR NATIONAL GUARD**  
**JACKSONVILLE, FLORIDA**

Location	EPA METHOD 601						EPA METHOD 602					
	Dichloro-	Dibromo-	Total	Chloro-	1,1-Dichloro-	Benzene	Toluene	benzene	Xylenes	Ethyl	Total	Tert-Butyl
	Chloro-	bromo-	chloro-									Methyl
FL Criteria				100 B*	6300 A		0.3 B	1 B	24 A	2 A	50 A	Total VOA
MW 1-1	<1	<1	<1	<1	<1		<1	<1	<1	<1	<1	<1
MW 1-2	<1	<1	<1	<1	<1		<1	<1	<1	<1	<1	<1
WP 2-12	<1	<1	<1	<1	<1		<1	<1	<1	<1	<1	<1
WP 2-13	<1	<1	<1	<1	<1		<1	<1	<1	1.2	<1	<1
MW 3E-1	<1	<1	<1	<1	2.8		3.7	31	8.1	26	110	<1
MW 3E-1 Duplicate	<1	<1	<1	<1	2.8		4.1	36	8.7	32	130	<1
MW 3E-2	<1	<1	<1	<1	<1		<1	<1	<1	<1	<1	<1
WP 3W-5A	<1	<1	<1	<1	<1		<1	<1	<1	<1	<1	<1
MW 5-1	<1	<1	<1	<1	<1		<1	<1	<1	<1	<1	<1
MW 5-2	1.7	<1	<1	1.7	<1		<1	1.8	<1	<1	<1	<1
MW A	<1	<1	<1	<1	<1		<1	<1	<1	36	29	<1
MW B	<1	<1	<1	<1	<1		<1	<1	<1	<1	<1	<1
MW C	<1	<1	<1	<1	<1		<1	7.5	<1	<1	6.7	45
WP 7-2A	<1	<1	<1	<1	<1		<1	<1	<1	<1	<1	<1
WP 7-5A	<1	<1	<1	<1	<1		<1	<1	<1	<1	<1	<1
MW 8-1	<1	<1	<1	<1	<1		<1	<1	<1	<1	<1	<1
MW 8-1 Duplicate	<1	<1	<1	<1	<1		<1	<1	<1	<1	<1	<1
MW 8-2	<1	<1	<1	<1	<1		<1	<1	<1	<1	<1	<1
MW 8-3	<1	<1	<1	<1	<1		<1	<1	<1	<1	<1	<1
<b>(Blanks ug/l)</b>												
Decon Water - HH	12	4.3	1.1	17.4	<1		<1	<1	<1	<1	<1	<1
Decon Water - CE	19	7.6	2.9	29.5	<1		<1	<1	<1	<1	<1	<1
Bailer Blank 1	<1	<1	<1	<1	<1		<1	<1	<1	<1	<1	<1
Bailer Blank 2	<1	<1	<1	<1	<1		<1	<1	<1	<1	<1	<1
Bailer Blank 3	<1	<1	<1	<1	<1		<1	<1	<1	<1	<1	<1
Field Blank 1	<1	<1	<1	<1	<1		<1	<1	<1	<1	<1	<1
Travel Blank 1	<1	<1	<1	<1	<1		<1	<1	<1	<1	<1	<1
Travel Blank 2	<1	<1	<1	<1	<1		<1	<1	<1	<1	<1	<1

**Notes:**

NA = Analyte Not Analyzed.

\* = Sum Of Total Trihalomethanes (Dichlorobromomethane, Dibromochloromethane, Bromoform, And Chloroform).

(1) = Analysis By EPA Method 624.

A = FDER Guidance Concentration.

B = Florida Drinking Water Standard.

Total VOA Defined By FAC 17-770 As Total Of Benzene, Toluene, Xylene, And Ethyl Benzene.

HH = Hush House Near Site 4; Potable Water For Gross Decontamination.

CE = Civil Engineering Building; Potable Water For Gross Decontamination.

**Table 5-13**  
**SUMMARY OF GROUNDWATER SAMPLE ANALYSES FOR**  
**METALS, TDS, AND TOTAL HARDNESS (ug/l)**  
**SECOND STEP OF THE SI**  
**125TH FIGHTER INTERCEPTOR GROUP, FLORIDA AIR NATIONAL GUARD**  
**JACKSONVILLE, FLORIDA**

Location	Cr	Pb	Fe	TDS	Total Hardness
FL Criteria	50 A	50 A	300 B	500,000 B	
MW 1-1	152	45.5	NA	NA	NA
MW 1-2	112	12 J	41,300	283,000	30,000
WP 2-12 Unfiltered	NA	5.9	NA	NA	NA
WP 2-12 Filtered	NA	2.8 J	NA	NA	NA
WP 2-13 Unfiltered	NA	5.6	NA	NA	NA
WP 2-13 Filtered	NA	1.5 J	NA	NA	NA
MW 3E-1	NA	NA	241,000	1,860,000	83,300
WP 3W-5A	NA	12.7	NA	NA	NA
MW 6-1	32.3	NA	NA	NA	NA
MW 6-2	128	NA	NA	NA	NA
WP 7-2A	NA	4.8 C	NA	NA	NA
WP 7-5A	NA	5.4 C	NA	NA	NA
<b>(Blanks)</b>					
Bailer Blank	< 5.5	< 0.92	NA	NA	NA
Decon Water - CE	< 5.5	3.8	NA	NA	NA
Decon Water - HH2	< 5.5	4.6 C	NA	NA	NA
Field Blank	< 5.5	< 0.92	NA	NA	NA
Travel Blank	< 5.5	1.5 J	41.9 C	NA	NA
Method Blank	< 5.5	< 0.9	50.1	<1,000	<1,000
Method Blank 2		1.7			

Notes:

NA = Analyte Was Not Analyzed.

< = Analyte Was Analyzed For But Not Detected Above The Reported Value.

A = Florida Primary Drinking Water Standard.

B = Florida Secondary Drinking Water Standard.

C = Analyte Was Not Detected Above Five Times The Value Reported In The Laboratory Blank.

J = Estimated Quantitation. Less Than Contract Required Detection Limit.

HH = Hush House Near Site 4; Potable Water For Gross Decontamination.

CE = Civil Engineering Building; Potable Water For Gross Decontamination.

**Table 5-14**  
**SUMMARY OF GROUNDWATER SAMPLE**  
**ANALYSES FOR CHROMIUM ( $\mu\text{g/l}$ ) AT SITE 6**  
**125th FIGHTER INTERCEPTOR GROUP**  
**FLORIDA AIR NATIONAL GUARD, JACKSONVILLE, FLORIDA**

Location	Chromium (unfiltered)	Chromium (filtered)
Florida Criteria	50	50
MW 6-1	9.9 B U	<3.3 U
MW 6-1 Duplicate	N/A	<3.3 U
MW 6-2	19.6 U	<3.3 U
WP 6-4	286	<3.3 U
WP 6-5	32.6 U	<3.3 U
WP 6-6	1,650	<3.3 U
Equipment Blank	10.4	N/A
Field Blank	7.2 B	N/A
Method Blanks	3.3 U	N/A

B = Reported value obtained is less than the contract required detection limit, but greater than or equal to the instrument detection limit.

U = Reported value obtained is greater than the instrument detection limit, but less than five times the amount reported in the equipment blank.

N/A = Analyte was not analyzed.

**Table 5-15**  
**SUMMARY OF SOIL SAMPLE ANALYSES FOR**  
**METALS (ug/kg)**  
**SECOND STEP OF THE SI**  
**125TH FIGHTER INTERCEPTOR GROUP, FLORIDA AIR NATIONAL GUARD**  
**JACKSONVILLE, FLORIDA**

Location	Depth (ft)	As	Ba	Cd	Cr	Pb	Hg	Se	Ag
MW 8-1	1.0-3.0	NA	9500	NA	4500	4600	NA	NA	NA
MW 8-1 Duplicate	1.0-3.0	NA	11200	NA	5300	4200	NA	NA	NA
MW 8-1	3.0-5.0	NA	17500	NA	4800	3500	NA	NA	NA
MW 8-2	1.0-3.0	NA	19400	NA	5100	4800	NA	NA	NA
MW 8-2	3.0-5.0	NA	22000	NA	6400	3700	NA	NA	NA
MW 8-3	1.0-3.0	NA	14200	NA	6000	4500	NA	NA	NA
MW 8-3	3.0-5.0	NA	14900	NA	3500	2600	NA	NA	NA
SB 8-5	1.0-3.0	NA	8300 J	NA	2500	3100	NA	NA	NA
SB 8-5	3.0-5.0	NA	22400	NA	6500	3700	NA	NA	NA
Background	1.0-2.0	140 J	3100 J	< 190	1800	3400	< 86	< 130	< 800

**Notes:**

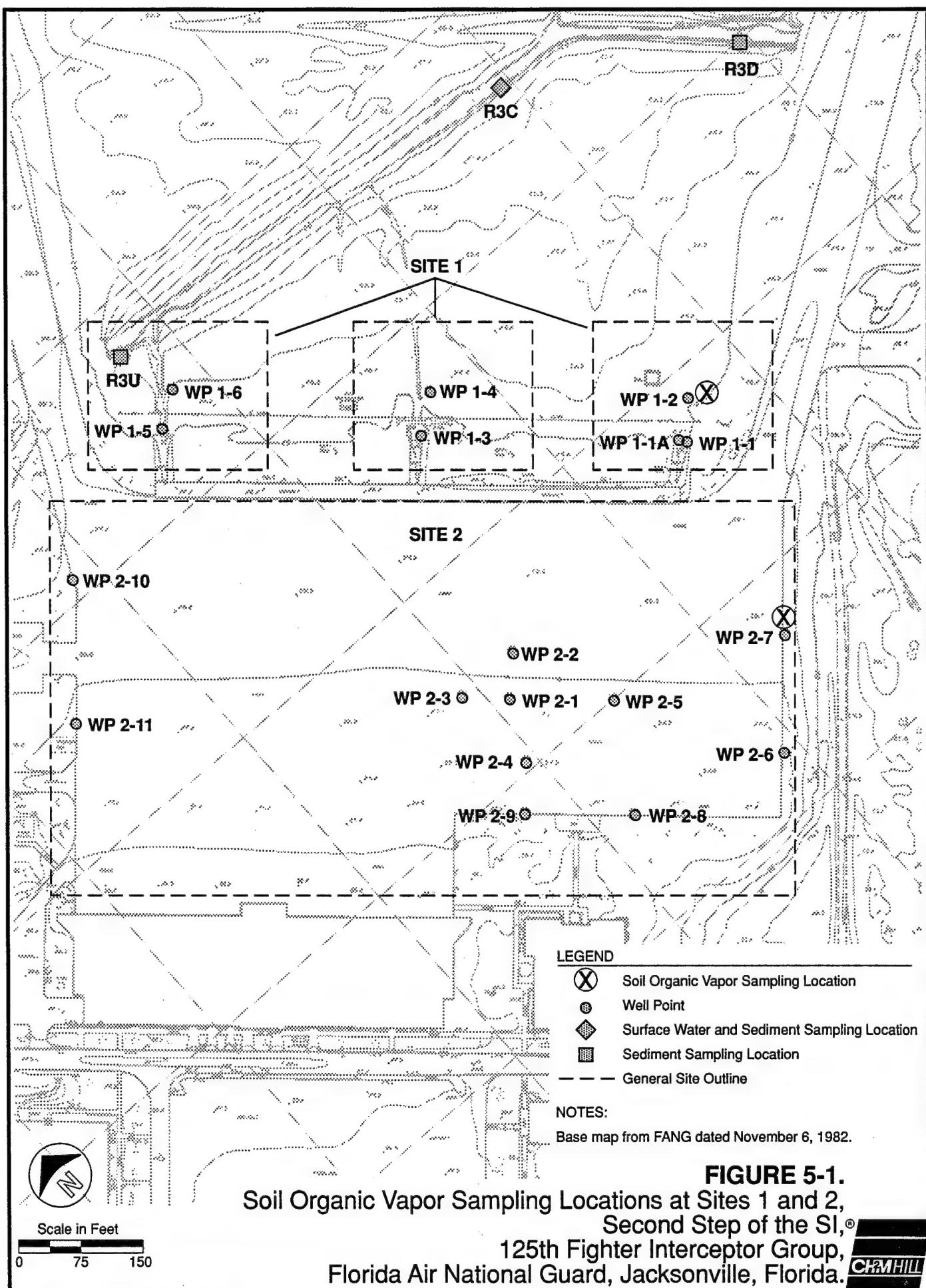
NA = Analyte Was Not Analyzed.

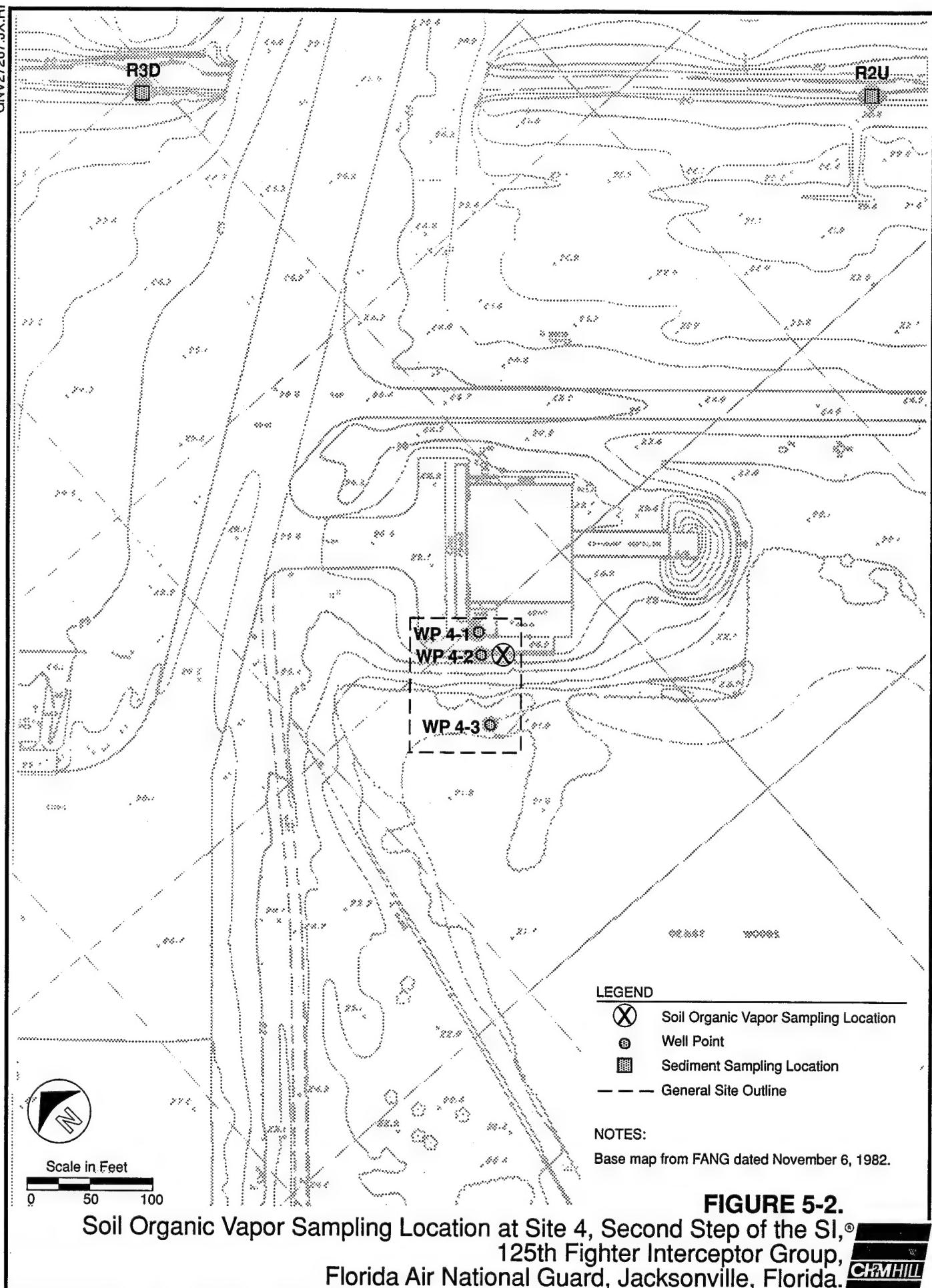
< = Analyte Was Analyzed For But Not Detected Above The Reported Value.

J = Estimated Quantitation. Less Than Contract Required Detection Limit.

**Table 5-16**  
**SUMMARY OF SEDIMENT AND**  
**SURFACE WATER SAMPLE ANALYSES FOR METALS**  
**SECOND STEP OF THE SI**  
**125TH FIGHTER INTERCEPTOR GROUP, FLORIDA AIR NATIONAL GUARD**  
**JACKSONVILLE, FLORIDA**

Location	As	Ba	Cd	Cr	Pb	Hg	Se	Ag
<b>Sediment (ug/kg)</b>								
DG 1	500 J	34800	< 220	4500	6100	< 98	< 150	< 930
DG 2	440 J	19100	280 J	6000	6200	< 100	< 150	< 940
Background	870 J	9100 J	< 220	4600	18600	< 100	170 J	< 930
<b>Water (ug/l)</b>								
* Fl Criteria	50		0.8 - 1.2	50	30	0.2	25	.07
DG 1	< 0.34	32.8 J	< 1.6	< 5.5	< 0.92	< 0.15	< 1.1	< 6.7
DG 2	1.4 J	40.3 J	< 1.6	< 5.5	2.5 B	0.35	< 1.1	< 6.7
<b>Notes:</b>								
N/A = Analyte Was Not Analyzed.								
< = Analyte Was Analyzed For But Not Detected Above The Reported Value.								
* = FAC 17-3 Water Quality Criteria For Class III Surface Waters.								
J = Estimated Quantitation. Less Than Contract Required Detection Limit.								
B = Analyte Was Not Detected Above Five Times The Value Reported In The Laboratory Blank.								





**FIGURE 5-2.**  
Soil Organic Vapor Sampling Location at Site 4, Second Step of the SI,  
125th Fighter Interceptor Group,  
Florida Air National Guard, Jacksonville, Florida.



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**SECTION 6**  
*Preliminary Risk Assessment*

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## **6. PRELIMINARY RISK ASSESSMENT**

Preliminary assessment of the risks to public health and the environment posed by the types and levels of contaminants reported at the eight sites at FANG includes the following components:

- Identification of the existing and potential routes by which receptors may be exposed to contaminants (exposure assessment)
- Definition of human health and environmental criteria (toxicity assessment)
- Characterization of cumulative risks to the affected population or environment from the site contaminants (risk characterization)

The Airport Master Plan<sup>9</sup> for Jacksonville International Airport addresses concerns for compatible land use surrounding the airport. Airport property boundaries extend over approximately 4,000 acres, and wetland areas have been identified in much of the adjacent property, which will further slow development in those areas. FANG property is leased until the year 2035 from the Jacksonville International Airport so future residential development would not be expected to occur on the property in the near future.

### **6.1 CONTAMINANT DATA EVALUATION**

Data summaries were prepared using data obtained through December 1989, as shown in Tables 6-1, 6-2, and 6-3, to identify the concentration and detection frequency of contaminants at the eight sites and in the onsite and downstream drainageways. Table 6-4 summarizes the contaminants by the media in which they were found. In Table 6-2, contaminant concentrations for Site 8 are separated out from the other sites, because of the generally higher levels of metals reported there. Table 6-3 separates surface water and sediment samples collected from Reaches 1 through 4 in the first step of the SI from those collected at downstream drainageway locations in the second step of the SI.

Qualifiers are added during the data validation process to suggest potential precautions in the use of the data. Estimated concentrations (denoted with a J) are retained for use in the preliminary risk assessment because the contaminant is known to be present, even though there is uncertainty about the precise concentration.

The data are discussed to identify potential biases that would affect the risk characterization. Constituents are identified that do not appear to originate at the sites under evaluation and are not, therefore, included in the preliminary risk assessment.

Silver, phenol, chloroform, and EDB were reported in a single surface water sample from the drainageways but were not detected in soil or groundwater samples from the eight sites or in sediment samples. These compounds will not be evaluated.

Tert butyl methyl ether was reported in one surface water sample and one groundwater sample from a monitor well installed by others at Site 5.

Several polynuclear aromatic hydrocarbon constituents were identified in one of the sediment samples but were not reported in soil, groundwater, or surface water samples. Because they do not appear to have originated from the sites, these constituents will not be addressed in the preliminary risk assessment. Similarly, bromomethane was detected only in two sediment samples and does not appear related to site activities, so it will not be addressed.

Trichlorofluoromethane was reported in four sediment samples. Although this compound was not reported in groundwater or soils at the sites, it may have been used in the FTAs and carried to sediments by runoff and will be addressed in the preliminary risk assessment.

The metals reported above background concentrations in sediment, soil, groundwater, and surface water samples will be included in the preliminary risk assessment. However, the high suspended solids levels found in the unfiltered groundwater samples could cause the metal results to be biased high, which would

affect their interpretation for assessing risk. A properly developed water supply well would not contain the level of particulates found in the well points. Migration of silt-size particles would also be slow.

Bis(2-ethyl-hexyl)phthalate was reported in groundwater samples at concentrations similar to those reported in the blanks. The compound was not detected in onsite soils but was reported in several sediment samples at concentrations near the detection limit. Detection limits were elevated for the two samples with the highest concentrations; the duplicate sample for one of these was below detection limits. Because phthalates are not likely to be associated with the potential contamination sources at FANG but are common laboratory contaminants, bis(2-ethyl-hexyl)phthalate will not be further evaluated in this assessment.

Methylene chloride was reported for only one of the 56 groundwater samples and only for EPA Method 624. Because the detected concentration is probably a result of laboratory contamination, the compound will not be further assessed.

The following contaminants were retained for evaluation in the preliminary risk assessment:

- Metals: Arsenic, barium, cadmium, chromium, lead, mercury, selenium
- Total volatile organic aromatics (as defined by FAC Chapter 17-70): Benzene, toluene, ethyl benzene, xylenes
- Chlorinated hydrocarbons: Chloroethane, chloromethane, 1,1-dichloroethane, 1,1,1-trichloroethane, vinyl chloride, t-1,2-dichloroethene, chlorobenzene, dichlorobenzenes, trichlorofluoromethane
- Semivolatile organics: Naphthalene, benzoic acid, 4-methyl phenol

## **6.2 CONTAMINANT FATE AND TRANSPORT**

The environmental fate and transport of contaminants at FANG are important factors in determining the potential for migration through and from the site and in assessing the potential for exposure. Environmental fate and transport depend on the physical and chemical properties of the contaminants, the environmental transformation processes affecting them, and the media through which they migrate.

Contaminants may migrate from the eight sites through groundwater flow or surface water runoff. The dense, fine grained soils limit permeability. The wells in the eastern portion of the site were bailed dry and sampled the following day, which suggests the shallow soils have relatively low permeability. This characteristic reduces the rate of infiltration of wastes and reduces the rate of leaching of contaminants during rainfall events.

In the eastern portion of FANG, the hydraulic conductivity of the surficial aquifer ranges from 1 to 2 ft/day and the groundwater velocity from 0.0025 to 0.125 ft/day. Hydraulic conductivity is approximately 5 ft/day in the western portion of FANG and groundwater velocity ranges from 0.0125 to 1.25 ft/day. Because the gradients are shallow, the average linear groundwater flow velocity at FANG was estimated to range from 0.0025 to 1.25 ft/day. A slow groundwater velocity reduces the rate of migration of contaminants within the groundwater as well as the rate of discharge to the drainageways.

Water levels in the Floridan aquifer in this area are greater than water levels in the surficial aquifer. This creates an upward hydraulic gradient that prevents contaminant migration from the surficial aquifer to the deeper Floridan aquifer, which is commonly used as a source of drinking water in the region. The Hawthorn Formation, which lies between the surficial and Floridan aquifers in the region, acts as a confining unit and would further impede groundwater flow between the two aquifers.

Flow of groundwater and contamination under natural conditions in the surficial aquifer tends to be lateral, toward surface drainage features such as the

drainageways at FANG. However, if groundwater is pumped from the Floridan aquifer at a sufficiently high rate to lower the potentiometric surface below the level of the surficial aquifer, downward flow of groundwater from the surficial aquifer to the Floridan aquifer could be induced. Using conservative assumptions, a dilution ratio of 1 to 250 was estimated for contaminant transport from the surficial aquifer to the Floridan aquifer. A much greater dilution would actually be expected, as this estimate does not account for chemical transformations or degradation of contaminants as they flow through about 400 feet of Hawthorn strata. Even if a downward gradient were induced by pumping of the Floridan aquifer, transport of groundwater and contaminants through the Hawthorn Formation would be unlikely in this area because of the thickness and lithology of the formation in the region.

### **6.2.1 Organic Contaminants**

A summary of the physical and chemical properties of the organic chemicals of concern at FANG is presented in Table 6-5. Key parameters affecting contaminant migration are volatility and water solubility. Highly soluble chemicals can be rapidly leached from wastes and soils and are generally more mobile in groundwater. Volatile constituents are removed more rapidly from surface water or soil.

The octanol-water partition coefficient ( $K_{ow}$ ) is often used to estimate the extent to which a chemical will partition from water into lipophilic parts of organisms (e.g., animal fat) and is correlated with partitioning to soil organic carbon ( $K_{oc}$ ), solubility, and the bioconcentration factor (BCF). It is a commonly available parameter used to estimate related properties when measured values are not readily available. BCF is defined as the concentration of a chemical at equilibrium in an organism (wet weight) divided by the mean concentration in water. Values of BCF range from about 1 to over 1,000,000.

The organic carbon partition coefficient ( $K_{oc}$ ) reflects the tendency of a compound to sorb to organic matter in soil. Higher sorption generally reflects lower solubility and therefore slower migration in groundwater. The contaminant velocity relative

to groundwater movement ( $V_w/V_c$ ) is defined by a retardation factor that is calculated as follows:

$$Rd = V_w/V_c = 1 + (B K_{oc} f_{oc})/P_t$$

where:

$V_w$	=	Velocity of groundwater
$V_c$	=	Velocity of contaminant
$Rd$	=	Retardation factor
$K_{oc}$	=	Partition coefficient for organic carbon
$f_{oc}$	=	Fraction of organic carbon in the soil
$B$	=	Bulk density
$P_t$	=	Total porosity

The organic carbon content of the soils measured at FANG ranges from 0.2 to 1 percent. Typically,  $B/P_t$  ranges from 4 to 10. Estimated retardation for constituents in Table 6-5, assuming  $B/P_t$  is 4, ranges from 1.01 for vinyl chloride at a low  $f_{oc}$  to over 4,000 for naphthalene at a  $f_{oc}$  of 0.01. Most constituents reported at these sites would migrate 10 to 250 times slower than the groundwater.

The degree of volatilization of contaminants depends on vapor pressure, water solubility, and diffusion coefficients. Vapor pressure is the relative measure of the volatility of chemicals in their pure state. Highly water soluble compounds generally have lower volatilization rates from water unless they also have high vapor pressures. The Henry's Law constant combines vapor pressure with solubility for estimating releases from water to air. Compounds with Henry's Law constants greater than  $10^{-3}$  atm-m<sup>3</sup>/mole can be expected to readily volatilize from water.

Several volatile organic constituents with relatively high aqueous solubilities, including the aromatics common in fuels and chlorinated solvents, were reported in groundwater samples from the eight sites. The volatile constituents would be slow to volatilize from subsurface soils and groundwater but would readily volatilize upon discharge to the drainageways. The chlorinated solvents have

relatively high mobility and degrade most readily under anaerobic conditions, which are likely at the sites where OVA readings indicated methane gas was present. The presence of a number of anaerobic biodegradation products of common solvents (e.g., vinyl chloride, 1,1-dichloroethane, chloroethane, and t-1,2-dichloroethene) suggests this process is occurring at FANG. Conversely, volatiles degrade most readily under aerobic conditions and will be more resistant to degradation in the anaerobic groundwater system.

The relatively low concentrations of contaminants detected in groundwater samples from the sites, as compared to their solubility, suggest there is no floating hydrocarbon plume, although the highest contaminant concentrations and most frequently detected constituents were fuel components. This is consistent with the absence of any measurable depths of floating hydrocarbons in the wells and well points installed during the SI.

### **6.2.2 Inorganic Contaminants**

Inorganic constituents may also migrate with groundwater or be carried with particulates into the drainageways. The mobility of metals depends on a number of factors, including oxidation state, dissolved organic constituents, and pH. Inorganic constituents detected at the sites in excess of drinking water standards include chromium and lead. Mercury concentrations in downstream drainageway samples exceeded water quality criteria. The form of these constituents affects both mobility and toxicity.

Lead is considered to have low mobility, particularly under reducing conditions where it would precipitate as lead sulfide.

Chromium can exist in aqueous solution as the trivalent cation Cr III or as an anion, where the oxidation state is Cr VI (hexavalent). In rock minerals, the predominant oxidation state is Cr III. The reduced form (Cr III) is less soluble and less mobile than the oxidized form. Migration of cations may be further retarded by cation exchange processes in the soils.

Hexavalent chromium is more toxic and mobile, so it presents a greater risk. Hexavalent chromium is readily reduced to the trivalent form in the presence of reduced iron (ferrous ion) but is not reoxidized easily. Under the reducing conditions present at FANG, as suggested by the methane, breakdown products of chlorinated solvents, and high iron concentrations indicative of ferrous ions, chromium would likely be reduced to the trivalent form.

Mercury may exist in inorganic or organic (alkyl) forms. Organic forms (e.g., methyl mercury) produced by methylation under reducing conditions are more readily absorbed.

Organomercuric compounds were widely used as biocides in paints, for treatment of seed grain, and in other applications until they were banned in the 1960s. Although mercury is rarely found in its naturally occurring elemental form, its tendency to volatilize can lead to wide dispersion. Elevated levels of mercury have been reported in numerous locations in Florida without a known source. A task force to investigate the high levels of mercury reported throughout Florida was recently established by Governor Bob Martinez. The source of the mercury problem seems to be associated with peat, particularly in areas of low pH waters and swamps. The reason for the elevated levels is unclear, but it may be related to the absorption of mercury to peat and the potential release of naturally occurring mercury following development of areas with peat soils.

The major removal mechanism for mercury from natural water systems is adsorption onto particulates and subsequent settling. The high organic content of the sediments favors the microbial methylation of mercury. Methyl mercury is the form most readily accumulated and retained in aquatic biota.

### **6.2.3 Impact of Site Contamination on Drainageways**

A point source of contamination discharging to a surface water body would be diluted by the surface water flow. Additional reductions in concentration would occur for many constituents as a result of processes like volatilization, biodegradation, or photolysis. Similarly, contaminants in soils would not increase in concentration upon discharge to the surface water body.

Comparison of site soil and groundwater concentrations to the sediment and surface water concentrations, as shown in Figures 6-1 and 6-2, suggests multiple sources may impact the drainageways. Several parameters were reported only in surface water, as shown in Table 6-4. Five of the seven metals in sediments exceeded concentrations shown in soils from the eight sites. Cadmium concentrations in both sediment and surface water samples significantly exceeded maximum site concentrations. The maximum reported groundwater concentration of lead (1,200J  $\mu\text{g/l}$ ) was higher than concentrations reported in surface water, but this level has been attributed mainly to particulates in well point samples. These concentrations would not represent anticipated exposure concentrations in a properly developed supply well. Concentrations were significantly reduced in monitor well and filtered well point samples.

In addition, several volatiles typical of fuels were reported in one of the surface water samples at concentrations that were more than an order of magnitude higher than those observed at the sites. Benzene, which would be expected to readily volatilize from surface water, was reported at 470  $\mu\text{g/l}$ . The presence of the fuel components may reflect transient releases to the drainageway from ongoing site activities.

Although some contaminant concentrations in samples obtained from the sites exceed those reported in surface water samples from the drainageways, the rate of discharge of groundwater to the drainageways is expected to be slow, with considerable dilution from other runoff and groundwater discharges. Therefore, based on current groundwater concentrations, surface water concentrations would not be expected to exceed criteria. In addition, downstream samples at DG-1 and DG-2 show significant decreases in sediment and surface water contaminant concentrations, suggesting that significant dilution will reduce surface water concentrations at downstream exposure points.

### **6.3 EXPOSURE PATHWAY ASSESSMENT**

The potential for exposure of human or environmental populations to contaminants at or originating from the eight disposal/spill sites at FANG is evaluated by an exposure pathway assessment. In identifying potential exposure

pathways, both current and possible future uses of the sites and surrounding areas were considered. A complete exposure pathway includes a contaminant source, a mechanism for contaminant release, an environmental transport medium, an exposure point (receptor location), and a route of exposure. Exposure may occur when contaminants migrate from the site to an exposure point or when a receptor comes into direct contact with waste or contaminated media at the site. An exposure pathway is complete if the receptor can take in contaminants through ingestion, inhalation, or dermal absorption of contaminated media or waste. Potential exposure pathways at FANG are summarized in Table 6-6.

Figure 6-3 illustrates physical features on the FANG property; the approximate locations where the photographs in Figure 6-3 were taken are shown in Figure 6-4. The nearest residences to FANG are located approximately 0.75 mile to the west, and access to the installation is restricted. The surrounding property is, and is expected to continue to be, owned by the Jacksonville International Airport, which has removed houses on property it has purchased in the vicinity of the airport. As a result, the potential future use of the FANG property and surrounding areas will probably not be residential. Reasonable maximum onsite exposures are based on use of these areas by site workers. It is assumed a maximum exposure duration for civilian base personnel is 40 years.

The following discussion presents exposure assumptions for each of the media of potential concern. Calculated intakes are summarized in Section 6.5.

### **6.3.1 Air**

The air pathway was not retained for evaluation in the risk assessment. Concentrations of volatile constituents at the sites were low and would make a negligible contribution to overall emissions from FANG. Dust would be minimized by the paving and vegetative ground cover.

### 6.3.2 Soils

Contaminants were reported in some sediment and surficial soil samples at concentrations above background. Under current land use conditions, primary receptors are onsite workers who may occasionally be in these areas.

Construction activities may increase worker exposures. There are no adjacent or onsite residential areas. Trespassers, including children, are not likely to gain access to the property, because access is restricted by fences and guards at the entrances. Worker exposures to site soils will be reduced by vegetative covers or paving and infrequent activity in these areas.

Under the assumption that routine maintenance may occur in these areas, it is possible that base personnel may be exposed through incidental ingestion or dermal absorption from surface soils. Input parameters for ingestion exposures assume an ingestion rate of 10 mg/event, which is one-tenth of the daily ingestion rate reported by the EPA for adults.<sup>10</sup> This value is used because exposures are expected to be brief. Additional assumptions include an exposure frequency of 12 events/year (once per month) for 40 years for a 70-kilogram adult worker.

Dermal absorption is a complex process and there is considerable uncertainty associated with estimating its magnitude. Skin is not highly permeable, although some chemicals (typically organic compounds) can be absorbed in sufficient quantities to produce systemic effects. For this evaluation, dermal absorption from soil is a function of the concentration of contaminants in the soil, the amount of soil in contact with the skin, the duration and frequency of the contact, and the type of contaminant. Regional default values for absorption factors from soil (EPA Region IV, personal communication, April 1990) are 1 percent for metals and 10 percent for organic compounds. The exposed skin area is assumed to be 2,940 cm<sup>2</sup>/day for an individual wearing a short-sleeved, open-necked shirt; pants; shoes; and no gloves or hat.<sup>11</sup> As with ingestion, it is assumed the receptor is a 70-kilogram adult worker exposed 12 days/year for 40 years.

### **6.3.3 Sediment**

Under current land use, direct human exposure to contaminated sediments underlying onsite surface waters is unlikely. Primary risks from sediment contamination, which will be qualitatively assessed, would be to the surface water ecosystem and humans as a result of toxicity or bioaccumulation and biomagnification through the food chain.

### **6.3.4 Surface Water**

Stormwater runoff and groundwater at FANG discharge to several surface drainageways, where selected constituents were intermittently detected. These drainageways also receive some discharges from the airport. Regional surface water drainage, which may intercept a significant portion of the shallow ground-water flow, is generally from west to east. The drainageway network flows east into a swampy area that appears to be drained by Cedar Creek. Transport of sediment in the drainageways is believed to be limited by low hydraulic gradients and the thick vegetation found throughout much of the drainageway network.

No public access is permitted to the onsite surface waters. Drainageway flow depends on rainfall events. Considerable vegetation grows on the banks of the drainageway north of FANG, making it unlikely to be used for recreation. Contaminants in surface water could result in exposure of aquatic organisms in the drainageways or downstream.

Potential human exposures may occur from consumption of fish or recreational use of Cedar Creek. Exposure of aquatic organisms or people who consume fish will be evaluated based on available water quality criteria. Surface waters at and surrounding FANG are not used as a drinking water supply. Recreational use exposures may include incidental ingestion or dermal exposures. These exposures will not be quantified, as the primary site-related constituents are below drinking water standards in the downstream samples and recreational uses would result in substantially lower exposures than from drinking the water.

### 6.3.5 Groundwater

Contaminants were reported in several monitor wells at concentrations above drinking water standards. Under current land use conditions, no exposure pathways are associated with shallow groundwater use. Shallow groundwater at FANG is not used for either domestic or agricultural purposes. Deep wells used for irrigation or potable water supply for the airport have been identified in areas with upward vertical groundwater gradients. Shallow groundwater from the site appears to discharge to the drainage ditches.

A request was made to the St. Johns River Water Management District for information on all wells and consumptive use permits on record for an area surrounding FANG and defined by Sections 17, 20, 21, 22, 27, 28, 29, 37, and 39 within Township 1 North and Range 26 East. No wells within 1 mile of FANG were found in district records.

On June 23, 1989, a visit was made to the City of Jacksonville Department of Bio-Environmental Services (JBES) to review records of wells in the FANG area. Eight water wells within approximately 1 mile of FANG were found in JBES files; available information is summarized in Table 6-7. The records listed four fire protection wells at the Jacksonville International Airport, two irrigation wells, and two wells with no specific usage.

Several private houses were previously located near FANG, according to FANG personnel and data on a U.S. Geological Survey (USGS) topographic map. Some of the wells listed by JBES may have been located at these houses, which were removed when the property was purchased by the Jacksonville International Airport. JBES also had records of five monitor wells within 1 mile of FANG: three in the FANG Vehicle Maintenance Compound and two used as UST compliance wells at the airport off Pecan Park Road.

The approximate locations of the water wells found in JBES records are shown in Figure 6-5. The "flowing well" shown in Figure 6-5 north of FANG was on the original USGS base map and has been abandoned, according to FANG personnel.

Three additional wells were identified by CH2M HILL within a 1-mile radius and are listed in Table 6-7. An old water supply well near the fire station at FANG is maintained for cooling water supply only, according to FANG personnel, and no data on depth or geology were available. Information from engineering staff at the Jacksonville International Airport indicates there are two wells on airport property currently used for potable water supply. The wells were both installed in 1967 and are each 1,200 feet deep. No other information was available on these wells, which supply drinking water for the airport and FANG.

The surficial groundwater flow directions at FANG are complex and variable and appear to be controlled by topography and surface drainage features. The hydrogeologic assessment indicates that the regional water table is relatively flat and that shallow groundwater flows in many directions locally. Water table elevations appear to be generally higher on the western sites, and on a regional scale, shallow groundwater may flow from west to east.

From the well inventory, it appears that shallow groundwater is not used in the area for potable supply. Deeper groundwater is used for potable supply at the airport, but available information suggests that contaminated shallow groundwater is not likely to migrate to that depth. Available literature suggests that the potentiometric surface of the Floridan aquifer exceeds the elevation of the water table, indicating a potential for upward groundwater flow. Several semi-confined units within the surficial aquifer were also indicated by cone penetrometer data.

Available information indicates no current pathway for exposures to shallow groundwater. Iron, TDS, and hardness were analyzed in two monitor wells for information on overall water quality in the shallow zone. Iron concentrations were above the secondary drinking water standard of 0.3 mg/l in both samples and TDS exceeded the 500 mg/l secondary standard in one sample. This suggests the general quality of shallow groundwater may not be desirable for drinking water supply. Future potable use of groundwater from the unconfined surficial aquifer is unlikely because of the undesirable water quality and the poor yield from the shallow aquifer.

A reasonable, maximum exposure, future use scenario assumes a well is placed in the deeper aquifer in the vicinity at the site to provide a potable water supply for onsite workers. A well placed in this zone would induce downward migration of the surficial contaminants. Attenuation of these constituents at the receptor location is estimated to be greater than 250 to 1, as discussed in Section 6.2. Ingestion rates of 1 liter/day are assumed for each working day (5 days/week, 48 weeks/year, 40 years) for a 70-kilogram adult worker.

### **6.3.6 Environmental Exposures**

The setting around the eight sites at FANG is mainly an urbanized area that extends northeast across the Jacksonville International Airport and includes buildings, paved areas (roads and runways), and mowed grass cover. A forested area is located approximately 1,000 feet to the south of FANG. Drainageway surface waters discharge to a wetland southeast of FANG. Another wetland northwest of FANG could be affected by shallow groundwater flows from Site 6.

Environmental exposures may result from direct contact or ingestion exposures as a result of contact with soils, sediments, surface water, or biota.

## **6.4 TOXICITY ASSESSMENT**

The toxicity assessment addresses both the carcinogenic and non-carcinogenic health effects of the contaminants. The EPA currently considers that there is no threshold of carcinogenicity (i.e., no level of exposure to a carcinogen that will not result in some finite possibility of causing the disease). There is a threshold of exposure related to non-carcinogens.

Five of the contaminants under consideration are classified as known or probable human carcinogens by the EPA Carcinogen Assessment Group. The carcinogen classifications are based on both animal and human studies and employ a weight-of-evidence approach because toxicological and epidemiological studies show such variation in quality and consistency. The following classifications are used:

- A: Human carcinogen

- B1: Probable human carcinogen, limited human evidence
- B2: Probable human carcinogen, sufficient evidence in animals, inadequate or no evidence in humans
- C: Possible human carcinogen
- D: Not classified as to human carcinogenicity

Non-carcinogenic health effects include a variety of toxic effects on organ systems and on developing fetuses. Constituents considered to be potential carcinogens are also capable of causing non-carcinogenic effects.

Toxicity depends on the dose of the substance. Critical toxicity values are a quantitative expression of the dose-response relationship for a chemical, which is the quantitative relationship between the dose of a chemical and the effect it causes. Critical toxicity values include cancer potency factors or reference doses (RfDs) specific to the exposure routes. The toxicity values used for FANG were obtained from EPA's Integrated Risk Information System (IRIS) data base for 1990. The RfDs and cancer potency factors used in this assessment are summarized in Table 6-8. Toxicological profiles of selected constituents reported at the sites are presented in Table 6-9.

## **6.5 RISK CHARACTERIZATION**

### **6.5.1 Methodology**

The approach used for estimating human health risks is summarized in Appendix G. Non-carcinogenic effects were assessed by comparison of the estimated daily intake of a contaminant to its RfD. For multiple chemicals, a "Hazard Index" approach that assumes dose additivity was used. If the Hazard Index is greater than 1, there may be a concern for a potential non-carcinogenic health risk.

The potential for carcinogenic effects associated with a given exposure was evaluated by estimating excess lifetime cancer risk, or the incremental increase in the probability of developing cancer over the background probability. For example, a  $10^{-6}$  excess lifetime cancer risk means that for every 1 million people exposed to the carcinogen throughout their lifetimes, the average incidence of cancer is increased by one extra case. Because of the methods followed, excess lifetime cancer risks should be regarded as upperbound estimates. The methodology calculates the upperbound of the 95th percentile confidence limit as the slope of the dose response curve and, therefore, should be considered an upperbound; the lower bound could be zero. While synergistic or antagonistic interactions might occur, carcinogenic risks within a route of exposure are treated as additive.

EPA is currently reevaluating the carcinogenic potency of arsenic and has recently adjusted its estimate of cancer potency for arsenic from 15 to 1.5 mg/kg/day. The agency is also considering other issues associated with arsenic, including the appropriateness of the current MCL of 50  $\mu\text{g/l}$ , the role of arsenic as an essential nutrient, and the treatability of arsenic-induced skin cancer.

No toxicological values (cancer potency factors or RfDs) are available from EPA concerning lead. EPA has proposed lowering the MCL to 10  $\mu\text{g/l}$  at the tap and 5  $\mu\text{g/l}$  at the treatment plant. The Hazard Index values calculated for FANG do not include risk from lead exposure because of the lack of toxicological assessment values.

### **6.5.2 Soils**

With the exception of xylene in a single sample, organic constituents were not reported in surface soils. Maximum soil concentrations were evaluated for incidental ingestion or dermal absorption by onsite workers to evaluate the need for potential restrictions on land use to protect human health. The non-carcinogenic risks are shown in Tables 6-10 and 6-11. The Hazard Index was less than 1 for these exposures, suggesting non-carcinogenic risks from the eight sites are not a concern.

The RfD for lead is currently being reevaluated by EPA. An interim soil cleanup level for total lead has been set by the Office of Emergency and Remedial Response and the Office of Waste Programs Enforcement at 500 to 1,000 mg/kg, which is considered protective for direct contact at residential settings. The highest lead concentration reported in site soils was 1.2 mg/kg.

Arsenic was the only carcinogenic soil constituent by ingestion reported in onsite soils. The excess lifetime risk for arsenic, as shown in Tables 6-12 and 6-13, is  $5 \times 10^{-9}$  for incidental ingestion and  $2 \times 10^{-8}$  for dermal absorption. These are based on the maximum site-wide arsenic concentration of 1,200K  $\mu\text{g}/\text{kg}$ . Detected concentrations in soils were as low as 180  $\mu\text{g}/\text{kg}$  and averaged about 620  $\mu\text{g}/\text{kg}$ .

### **6.5.3 Surface Water and Sediments**

Direct contact with contaminated sediments is not a primary human exposure pathway. Drainageway surface waters would not be suitable for recreational swimming and water sports because the water is shallow and mixed with vegetation.

Cedar Creek is a potential offsite exposure point, but contaminant concentrations in surface water decreased substantially at the downstream sampling locations. Additional reductions would occur before migration offsite of the airport property boundary to public access areas. Potential impacts on aquatic life are discussed in Section 6.6. Table 6-14 compares groundwater and surface water concentrations with the Federal Ambient Water Quality Criteria (FAWQC) for protection of human health from consumption of fish.

No FAWQC for organic constituents were exceeded in downstream sample locations. The criterion for benzene was exceeded in a single groundwater and surface water sample onsite, but the high volatility of this compound would rapidly reduce its concentration in downstream locations.

Arsenic and mercury criteria were exceeded in downstream locations. The criteria for these constituents are low (below detection limits). These constituents appear

to be generally present in this area at low concentrations and do not appear to result from activities at any of the eight sites.

#### **6.5.4 Groundwater**

The shallow aquifer from which groundwater samples were collected is not used for water supply and, based on the hydrogeologic assessment, is not likely to be exploited as a source of water supply.

Table 6-15 summarizes the non-carcinogenic risks associated with ingestion of groundwater from the lower potable aquifer based on the maximum estimated groundwater concentration for all the sites with the 250- to -1 dilution. The daily intakes for non-carcinogenic constituents besides lead and arsenic do not exceed the associated RfD for the contaminants reported in groundwater; this suggests that the non-carcinogenic risks for individual constituents are not a concern. The Hazard Index for estimated maximum concentrations throughout FANG is also less than 1.

The Hazard Index calculations do not include lead and arsenic. Current drinking water standards for lead ( $50 \mu\text{g/l}$ ) were exceeded at Sites 1 and 2 in well point samples collected during the first step of the SI, but concentrations from monitor well samples were below the standard. The proposed standard ( $5 \mu\text{g/l}$ ) was exceeded at all sites except Site 5. Lead was present in all groundwater samples and proposed criteria were exceeded in several, but a definable plume of lead is not apparent. Because lead occurs naturally and is generally strongly sorbed, the concentrations may be attributable to silt and particulates, particularly in well point samples. Arsenic was not reported above the MCL.

The primary carcinogenic risks associated with the eight sites are from arsenic and benzene. Arsenic was not, however, reported above drinking water standards in any of the groundwater samples and appears to be ubiquitous at FANG, as it was detected in all soil and sediment samples (including background) and two-thirds of the surface water and groundwater samples. The maximum groundwater concentration of arsenic was  $9.2 \mu\text{g/l}$ , as compared to the drinking water standard of  $50 \mu\text{g/l}$ .

Organic constituents will continue to degrade and would not be present at current concentrations over a lifetime of exposure. Many of the organic constituents were detected in fewer than 10 percent of the samples analyzed and, although intermittently detected, do not appear to represent a definable plume.

Excess lifetime cancer risks associated with potential future ingestion of groundwater from the lower aquifer are summarized by site in Table 6-16. Excess lifetime cancer risks range from  $3 \times 10^{-9}$  at Site 2 to  $3 \times 10^{-7}$  at Site 1. Carcinogenic risks are primarily attributed to arsenic and benzene.

#### **6.5.5 Summary**

Current risks to human health from the eight sites are low because of low exposures. No drinking water pathway is present, and there are no nearby residences to potentially increase direct exposures. The primary pathway for exposure is potential ingestion of contaminated fish, but fishing would be expected to occur at downstream locations where contaminant concentrations are lower than in the drainageways at FANG. In addition, multiple sources at both FANG and Jacksonville International Airport appear to contribute to the elevated metals in the drainageways, and it is not clear that the current concentrations in surface water are a result of migration from the eight sites.

The Airport Master Plan<sup>9</sup> and Airport Noise Control Land Use Compatibility Studies<sup>12</sup> support a long-term commitment to restrictions on residential land use in this area. The current lease held by FANG extends for 45 years, to the year 2035. Soil samples do not exceed acceptable levels for incidental ingestion or dermal absorption exposures that may occur for workers. Non-carcinogenic risks are not exceeded for use of the lower aquifer as a drinking water supply. The highest excess lifetime cancer risk was  $3 \times 10^{-7}$  at Site 1 based on conservative assumptions regarding potential future use of a potable water well completed in the deep aquifer in this area.

### **6.5.6 Uncertainties in Risk Estimation**

This section discusses the key assumptions and uncertainties that affect the level of confidence placed on risk estimates for this site. Because uncertainties are inherent to any risk assessment, a qualitative discussion of these uncertainties provides perspective on the risks calculated for a site. These uncertainties are generally associated with the following factors:

- Selection of chemicals
- Likelihood of exposure pathways and land uses actually occurring
- Methods for calculating exposure concentrations
- Parameters and assumptions used to estimate exposures
- Selection of cancer slope factors and RfDs
- Significant data gaps

The process of selecting contaminants of potential concern for FANG eliminated laboratory contaminants and constituents that are not site related. The data review suggests that some constituents may show elevated groundwater concentrations as a result of the presence of particulates, which would tend to overestimate risks.

Workers may occasionally enter the areas encompassed by the sites. Maximum soil concentrations were used to estimate potential incidental ingestion or dermal absorption risks associated with contact with soil, although some of the samples were subsurface and contact would only occur if activities disturbed the soil. This assumption would, therefore, tend to overestimate risks associated with the sites. Maintenance activities in the area are expected to be intermittent as estimated, but the dose per event may be higher (e.g., 100 mg/day) depending on the activity. If the dose were increased, risks would still remain at acceptable levels. The assumption that a worker would perform these activities at the sites for 40 years is conservative and likely overestimates risks associated with this exposure pathway.

Shallow groundwater is not currently used for potable water. The low yields possible with this source also make it unlikely to be developed for this use in the future. The worst-case exposure may occur as indicated, for a well placed in the

lower aquifer where other wells in the area are located. The estimated concentrations, based on assumptions of pumping in the lower aquifer, would exceed the assumed dilution. As these concentrations generally represent localized contaminant areas, risks associated with development of the lower aquifer are overestimated.

Debate continues over the most appropriate methods to determine average and reasonable maximum exposure conditions. According to the guidelines, the 95 percent upper confidence limit on the arithmetic average should be used for calculating exposure. However, environmental data are not often normally distributed and samples are not randomly collected. Infrequently reported constituents preclude the ability to use these statistical methods.

Uncertainty is also associated with the method used to determine carcinogenic risks in humans. In discussing uncertainty, the EPA expressed the following opinion:

"It should be emphasized that the linearized multistage procedure leads to a plausible upper limit to the risk that is consistent with some proposed mechanism of carcinogenesis. Such an estimate, however, does not necessarily give a realistic prediction of the risk. The true value of risk is unknown, and may be as low as zero. The range of risks, defined by the upper limit given by the chosen model and the lower limit which may be stated as low as zero, should be explicitly stated (51 Federal Register 33998)."

The toxicological data base is also a source of uncertainty. EPA indicates some of the sources of uncertainty include extrapolation from high to low doses and from animals to humans; species differences in uptake, metabolism, and organ distribution; species differences in target site susceptibility; and human population variability with respect to diet, environment, activity patterns, and cultural factors.

Not all chemicals found at the site (e.g., lead) have been assigned critical toxicity values. Although lead is not included in the quantitative assessment, it did not exceed criteria proposed for soils nor would it be expected to transport to the

lower aquifer and be present at that exposure point in excess of drinking water standards.

## **6.6 ENVIRONMENTAL ASSESSMENT**

A qualitative assessment was made of the potential environmental exposures in the vicinity of FANG. The assessment considered primarily the intermittently high levels of mercury (above the 0.2 µg/l Class III water quality criterion) and detectable concentrations of other compounds at a few surface water sampling locations at FANG. A site visit was made to identify unnatural stresses in flora or fauna present along the drainageways and to characterize the habitat and its potential to attract other sensitive biological receptors.

### **6.6.1 Setting**

The drainageway extends approximately 5,000 feet across the FANG property in an easterly direction before entering a large wetland offsite. Another wetland northwest of FANG could be affected by shallow groundwater flow from Site 6. The northern drainageway (Reach 2) varies from 5 to 20 feet in width and from 2 inches to at least 3 feet deep in downstream pools. Surface water is clear and slow flowing; the drainageway appears to be continuously wet as a result of groundwater inflow.

The drainageway is inundated with cattails along its entire length, with occurrences of sawgrass, water pennywort, buttonbush, rushes, and mats of filamentous algae. The sediment consists of soft clayey material overlain by several inches of organic detritus and has no discernible odor.

### **6.6.2 Receptors**

Aquatic organisms observed during an onsite inspection include the freshwater limpet, crayfish, numerous mosquitofish (*Gambusia affinis*) and several sunfish in deeper pools. Evidence of muskrat and armadillo activity was seen in and along the drainageway. Turkey vulture, killdeer, American robin, and white ibis were also observed.

No recognizable pollution stress was observed for vegetation or aquatic organisms in the drainageway. Further qualitative or quantitative sampling techniques would be necessary to more accurately detect environmental stress.

The Hazardous Materials Technical Center<sup>1</sup> reports that the Florida Game and Freshwater Fish Commission indicated that no endangered or threatened species of flora or fauna were observed in the vicinity of FANG. The center also reports that there are no areas designated as critical habitats or wilderness.

Tables 6-17 and 6-18 list 11 threatened plant species and 23 aquatic and terrestrial vertebrates listed as endangered, threatened, or species of special concern that have the potential to occur at FANG. None of these species was observed in the drainageway leading from the FANG property to the offsite wetland. Most of the listed vertebrate and invertebrate species are unlikely to make use of habitat on the FANG property because of unsuitable conditions. Species with the greatest potential for using the habitat in or along the drainageway are the American alligator, limpkin, little blue heron, snowy egret, tri-colored heron, American wood stork, kestrel, and peregrine falcon.

American alligators have been observed on the installation by FANG personnel. Alligators are unlikely to remain permanently in the drainageway, however, because of human disturbance, low water, and more optimal conditions in the nearby wetlands. Contaminated prey items, such as fish, crayfish, and amphibians, could be minimal indirect sources of exposure to onsite contaminants.

Wading birds, such as the limpkin, little blue heron, snowy egret, tri-colored heron, and American woodstork, may find portions of the drainageway suitable for occasional foraging on fish and invertebrates. The scarcity of the primary food of the limpkin, apple snails, in the area reduces the probability of limpkin presence. Exposure to wading bird species would be through direct ingestion of contaminated water, sediments, and food items such as fish and invertebrates.

The American kestrel prefers open areas for hunting and primarily eats insects. The bird is likely to occur in the area but its exposure to pollutants should be

minimal; the only potential source would be ingestion of emergent aquatic insects from the drainageway.

The peregrine falcon may use open areas on the FANG property for hunting small birds but should not be directly affected by surface water or sediment contamination.

### 6.6.3 Contaminant Levels

Mercury, chromium, cadmium, and lead were detected in onsite surface waters at concentrations exceeding the Class III surface water quality criteria, as shown in Table 6-19. The two contaminants that may be ecologically important at FANG are mercury and chromium. Mercury exceeded the water quality criterion in surface water samples, but its distribution is widespread and does not appear associated with specific activities at the eight sites. Groundwater concentrations of chromium at Site 6 are higher than Class III surface water quality criteria, which could potentially affect nearby wetlands. Mercury and chromium toxicities are described below. Information is also provided on the potential for aquatic and terrestrial toxicity from cadmium and lead.

#### Mercury

Mercury has been measured at two sampling points at concentrations exceeding the Florida criterion of 0.2 µg/l for Class III surface waters; the highest concentration was 0.68 µg/l at R1C. The downstream concentration was 0.35 µg/l at DG-2. The most recent mercury criterion proposed by EPA for the protection of freshwater aquatic life is 0.012 µg/l median (4-day average), not to exceed 2.4 µg/l on an hourly average. Acutely toxic values of mercury for invertebrate species range from 2.2 µg/l for *Daphnia pulex* to 2,000 µg/l for three insects. Acute values for fishes range from 30 µg/L for the guppy to 1,000 µg/l for the Mozambique tilapia.

Methyl mercury is the most chronically toxic of the tested mercury compounds. Tests with *Daphnia magna* and brook trout produced chronic toxicity values of less than 0.07 µg/l for methyl mercury. Freshwater plants show a wide range of

mercury sensitivity, but the most sensitive plants appear less sensitive than the most sensitive freshwater animals to both mercury and methyl mercury. Therefore, freshwater organisms are more susceptible to mercury contamination.

Mercury can be bioconcentrated in organisms and biomagnified through food chains. BCFs (tissue concentration of a chemical divided by exposure concentration) are 4,000 to 85,000 for methyl mercury and about 5,000 for mercury. The primary concern at FANG is that mercury will pass from contaminated food items up the food chain to endangered species. For the protection of sensitive species of mammals and birds that regularly consume fish and other aquatic organisms, total mercury concentrations in prey items should probably not exceed 100 µg/kg fresh weight for birds and 1,100 µg/kg for small mammals.<sup>13</sup>

In fish, the biological half-life of mercury is approximately 2 to 3 years. Data concerning long-term exposure of fish to mercury indicate that concentrations above 0.23 µg/l caused statistically significant effects on the fathead minnow and caused the concentration of total mercury in the whole body to exceed 1.0 mg/kg.

Signs of mercury poisoning in birds include lack of muscular coordination, slowness, withdrawal, and slow response time. Acute oral toxicities of various mercury formulations ranged between 2.2 and 31.0 mg/kg body weight for most bird species tested.<sup>13</sup> Sublethal adverse effects of mercury on birds have been noted for growth, development, reproduction, blood and tissue chemistry, metabolism, and behavior. The proposed mercury criterion for protection of birds is a daily dose of less than 640 µg/kg.

Mercury has not been detected consistently at the two sites on FANG where it has been measured. The presence of mercury at FANG may be related to the chronic low levels of mercury found statewide. Specific sources of mercury in Florida are unknown, but the levels found may be the result of its ubiquitous occurrence in nature, smoke stack emissions, runoff of agricultural pesticides, or discharge from industrial plants.

The fluctuations in mercury concentrations in surface water samples indicate that aquatic organisms are not chronically exposed to high levels of mercury and,

therefore, are unlikely to be adversely affected. Fish tissue analysis could be used to evaluate long-term exposure and potential impacts on aquatic or terrestrial food chains.

### **Chromium**

Chromium was measured at a maximum concentration of 152 µg/l in groundwater. At this level, chromium could impact adjacent wetlands if groundwater were to infiltrate the low lying areas.

Chromium occurs in natural water bodies as trivalent chromium, hexavalent chromium, or both. The chemical and toxicological properties of the two oxidation states appear quite different, and the toxicities of the two states have not been shown to be additive. Records of acute toxicities of hexavalent and trivalent chromium salts to representative aquatic species confirm that hexavalent chromium is more toxic to freshwater biota in comparatively soft and acidic waters.<sup>14</sup> Based on the reducing conditions observed at FANG (Section 6.2.2), chromium is expected to be present in groundwater in the trivalent form.

The acute toxicity of hexavalent chromium to aquatic species appears to increase as pH and/or hardness decrease.<sup>15</sup> Bioaccumulation has been found to vary among species; concentrations are normally highest at lower trophic levels and the lowest with the top predators, indicating that biomagnification does not occur. A BCF of 3.4 was found for hexavalent chromium in rainbow trout. Ambient water quality criteria for hexavalent chromium are not to exceed 0.29 µg/l as a 24-hour average and not to exceed 21 µg/l at any time.<sup>16</sup>

Acute values for trivalent chromium for freshwater animal species range from 2,221 µg/l for a mayfly to 71,060 µg/l for a caddisfly.<sup>17</sup> A BCF has not been measured with freshwater organisms for trivalent chromium. For hardness values of 50, 100, and 200 mg/l as CaCO<sub>3</sub>, the ambient water quality criteria established for 4-day average concentrations of trivalent chromium are 120, 210, and 370 µg/l, respectively. The 1-hour average concentrations for the same hardness values are 980, 1,700, and 3,100 µg/l.<sup>17</sup>

The average chromium concentration reported in surface water at FANG does not exceed Class III surface water quality criteria or FAWQC for trivalent chromium.

### Cadmium

In aquatic systems, hardness affects the toxicity of cadmium. Chronic toxicity values for fathead minnows and *Daphnia magna* tested over a range of hardness found a significant correlation between hardness and toxicity.<sup>18</sup> Ambient water quality criteria state that the freshwater organisms will not be unacceptably affected if the 4-day average concentration does not exceed  $e^{(1.128[\ln(\text{hardness})]-3.828)}$  in  $\mu\text{g/l}$ , and if the 1-hour average concentration is not in excess of  $e^{(0.7852[\ln(\text{hardness})]-3.490)}$  in  $\mu\text{g/l}$ , more than once in 3 years. Using a hardness of 50 mg/l CaCO<sub>3</sub>, the acute criterion for cadmium is 1.8  $\mu\text{g/l}$  and the chronic criterion is 0.66  $\mu\text{g/l}$ . In a 21-day test, a 16 percent reduction in reproduction at 0.7  $\mu\text{g/l}$  (nominal concentration) was found. Chronic toxicities of cadmium to *Daphnia pulex* were found at less than 1  $\mu\text{g/l}$  and 10  $\mu\text{g/l}$ . BCFs for cadmium in freshwater range from 3 for brook trout muscle to 12,400 for whole body mosquitofish. Accumulated cadmium is slowly depurated by freshwater organisms.

There is no evidence that cadmium is an essential mineral.<sup>19</sup> Mammals have no effective mechanism for the elimination of ingested cadmium; therefore, with time, the cadmium tends to accumulate in the liver and kidney. It tends to be very persistent in the kidney and can cause renal tubular damage.<sup>20</sup> Toxic effects include decreased growth rates, anemia, infertility, fetal abnormalities, abortions, kidney disease, intestinal disease, and hypertension. The acute oral LD<sub>50</sub> for cadmium sulfide is greater than 5,000 mg/kg.<sup>21</sup> In a 30-month study with rats, elevated blood pressure occurred at the lowest level tested, 1 ppm.<sup>20</sup> Mallard ducks were chronically dosed with cadmium-contaminated food and found to have significant effects on energy metabolism at 450 mg/kg. The maximum tolerable level set by the National Academy of Science<sup>20</sup> for domestic mammals and poultry is 0.5 ppm.<sup>22</sup>

## **Lead**

The primary mechanism of acute toxicity of lead to freshwater organisms is unknown. In acute assays, invertebrate species are more sensitive than vertebrate species. The lowest maximum acceptable toxicant concentration from chronic studies is 19 mg/l for rainbow trout (*Salmo gairdneri*) at a water hardness of 128 mg/l CaCO<sub>3</sub>. Lead toxicity decreases with increasing water hardness. EPA has established 4-day and 1-hour average concentration criteria for lead not to be exceeded by the values given by  $e^{(1.273[\ln(\text{hardness})]-4.705)}$  and  $e^{(1.273[\ln(\text{hardness})]-1.460)}$ , respectively, more than once every 3 years.<sup>23</sup> Using an average water hardness of 50 mg/l CaCO<sub>3</sub>, the 4-day and 1-hour criteria correspond to 1.3 and 34 µg/l, respectively.

In American kestrels (*Falco sparverius*) fed 10 or 50 mg/kg lead in the diet for 7 months, no effects were noted with respect to survival, egg laying, initiation of incubation, or egg shell thickness. In 1-day-old American kestrels fed 125 or 625 mg/kg body weight lead for 10 days, growth was seriously depressed by day 6, and hematocrit values were significantly depressed by day 10. Forty percent of the birds receiving 625 mg/kg lead died within 6 days. No effects were observed in kestrels exposed to 25 mg/kg body weight. The 50-mg/kg level is the highest No Observable Effect Level identified for birds based on the studies reviewed.<sup>22</sup>

Lead inhibits plant growth and reduces photosynthesis, mitosis, and water absorption.<sup>24</sup> Inhibition of photosynthesis is attributed to the blocking of protein sulfhydryl groups and to changes in phosphate levels in the cell.<sup>24</sup> Normal germination rates were observed at soil lead levels of 46 mg/kg but other adverse effects were observed at lead levels of 12 to 312 mg/kg in soil.<sup>24</sup>

### **6.6.4 Summary**

Class III surface water quality criteria for mercury, chromium, and cadmium were exceeded in onsite drainageway samples but only mercury was found above the standard downstream of FANG. Mercury has the potential to bioaccumulate in animal tissue and biomagnify through the food chain. The source of the mercury has not been identified, nor has it been clearly established as migrating from any

of the sites on FANG. Chromium detected in Site 6 groundwater could migrate to a nearby wetland, although the slow rate of migration and dilution effects make it unlikely that the concentrations that ultimately enter the wetland will exceed Class III criteria. Cadmium was not detected in downstream surface water samples above the applicable criterion and is unlikely to have an ecological impact.

**Table 6-1**  
**MAXIMUM CONTAMINANT CONCENTRATIONS AND FREQUENCY OF**  
**DETECTION IN SITE INVESTIGATION GROUNDWATER SAMPLES**  
**125TH FIGHTER INTERCEPTOR GROUP,**  
**FLORIDA AIR NATIONAL GUARD, JACKSONVILLE, FLORIDA**

Contaminant	Range of Detected Concentrations	Frequency of Detection	Average <sup>a</sup>
<b>Site 1</b>			
Benzene	41	1/8	--
Toluene	1	1/8	--
Xylenes	13 J	1/8	--
Bis(2-ethyl hexyl)phthalate	4 BJ	1/1	--
Arsenic	2.8 J - 8.2 J	2/2	5.5 J
Barium	360	1/1	--
Cadmium	3.95 J	1/1	--
Chromium	107.65 - 152	3/3	123.88
Lead	4 B - 66.75	8/8	28.37 BJ
Mercury	0.2 J	1/1	--
Selenium	0.94 J - 1.4 J	2/2	1.04 J
<b>Site 2</b>			
Benzene	2 - 5	2/7	--
Ethyl Benzene	3 J - 7 J	2/7	--
Toluene	2	1/7	--
Xylenes	1.2 - 160 J	4/7	24.67 J
Lead	5.6 - 1,200 J	5/5	390.3 J
<b>Site 3</b>			
Benzene	25 - 35	3/13	--
Ethyl Benzene	1 J - 29	4/13	--
Toluene	2 - 17	4/13	--
Xylenes	7 J - 120	3/13	--
Chloroethane	2.8	1/3	--
1,1-Dichloroethane	3.9 - 13 J	3/13	--
t-1,2-Dichloroethane	12 J - 24 MJ	2/10	--
Methylene Chloride	8	1/1	--
Vinyl Chloride	4 J	1/10	--
2-Hexanone	9 J	1/1	--
4-Methyl-2-Pentanone	73	1/1	--
Acetone	2,500 J	1/1	--
Bis(2-ethyl hexyl)phthalate	3 BJ	1/1	--
Chlorobenzene	2	2/10	--

**Table 6-1**  
(continued)

Contaminant	Range of Detected Concentrations	Frequency of Detection	Average <sup>a</sup>
Arsenic	6 J	1/1	--
Barium	574	1/1	--
Chromium	46 M	1/1	--
Lead	2.6 B - 31.2 J	13/13	11.65 BJ
Mercury	0.41 L	1/1	--
Selenium	1.5 J	1/1	--
<b>Site 4</b>			
Benzene	5	1/3	--
Ethyl Benzene	2 J - 4 J	2/3	3 J
Toluene	2 - 3	2/3	2.5
Xylenes	25.5 - 26	2/3	25.75
4-Methyl Phenol	210	1/1	--
Benzoic Acid	1,300 J	1/1	--
Chlorobenzene	1 J	1/3	--
Arsenic	5.2 J	1/1	--
Barium	34.1 J	1/1	--
Cadmium	3.1 J	1/1	--
Chromium	25.7 J	1/1	--
Lead	3.8 - 17.45	3/3	10.65
Mercury	0.2 J	1/1	--
<b>Site 5</b>			
Benzene	1.8 - 60	3/8	--
Ethyl Benzene	19 J - 36	2/8	--
Toluene	1	1/8	--
Xylenes	1 - 29	3/8	--
Chloromethane	1 J	1/3	--
Arsenic	2.7 J	1/1	--
Barium	48 J	1/1	--
Cadmium	4 J	1/1	--
Chromium	7.7 J	1/1	--
Lead	2.2 J	1/1	--
Mercury	0.16 J	1/1	--
<b>Site 6</b>			
Ethyl Benzene	6 J	1/3	--
Xylenes	1	1/3	--

**Table 6-1**  
**(continued)**

Contaminant	Range of Detected Concentrations	Frequency of Detection	Average <sup>a</sup>
Chloromethane	1 J	1/3	--
Trichloroethane	1 J	1/3	--
Arsenic	1 J	1/3	--
Barium	121 J - 245	3/3	194 J
Chromium	32.3 - 128	5/5	89.02
Lead	12.4 - 32.4	3/3	22
Mercury	0.41 J - 0.53 J	3/3	0.46 J
<b>Site 7</b>			
Lead	4.8 B - 10.6	7/7	6.4 B
<b>Site 8</b>			
Benzene	7 - 26	2/7	--
Ethyl Benzene	12 J - 150 J	2/7	--
Naphthalene	26 - 89	2/4	29.25
Toluene	2 - 39	3/7	--
Xylenes	28 - 430	3/7	--
1-Methyl Naphthalene	28	1/3	--
2-Methyl Naphthalene	44 - 45	2/4	22.75
t-1,2-Dichloroethene	2 J	1/4	--
Vinyl Chloride	1 &J	1/4	--
4-Methyl Phenol	4 J	1/1	--
Bis(2-ethyl hexyl)phthalate	6 BJ	1/1	--
Chlorobenzene	9 J - 35 J	2/4	11.25 J
1,2-,1,4,-Dichlorobenzene	2 J - 34 J	4/5	8.70 J
1,3-Dichlorobenzene	2 J - 6 J	3/5	2.50 J
Arsenic	3 J	1/1	--
Barium	334	1/1	--
Cadmium	3.8 J	1/1	--
Chromium	7.5 J	1/1	--
Lead	1.9 B - 26.5	4/4	8.44 B
Mercury	0.49 J	1/1	--

Notes:

B = Analyte was not detected above five times the value reported in laboratory blanks.

**Table 6-1**  
**(continued)**

- J = Estimated. Analyte was present but the reported value may not be accurate or precise.
- M = Duplicate precision was not met. It is not possible to determine whether the resulting bias is high or low.
- & = Combined vinyl chloride and dichlorofluoromethane (used packed column to meet the holding time).

<sup>a</sup>Arithmetic mean concentrations are calculated using all values. Values below the detection level are assumed to be at one-half the detection level. Averages were not calculated if less than 50 percent of the samples were detects.

**Table 6-2**  
**CONTAMINANT CONCENTRATIONS AND FREQUENCY OF DETECTION**  
**IN SITE INVESTIGATION SOIL SAMPLES**  
**125TH FIGHTER INTERCEPTOR GROUP,**  
**FLORIDA AIR NATIONAL GUARD, JACKSONVILLE, FLORIDA**

Contaminant	Sites 1, 3-7			Site 8			Background Concentration (mg/kg)
	Maximum Concentration (mg/kg)	Average Concentration <sup>a</sup> (mg/kg)	Frequency	Maximum Concentration (mg/kg)	Average Concentration <sup>a</sup> (mg/kg)	Frequency	
Arsenic	1.2 K	0.55	7/7	1.1 J	1.1	1/1	0.14 J
Barium	5.9 J	4.3	7/7	51.9	20.2	9/9	3.1 J
Cadmium	0.62	-	1/7	<0.21	<0.21	0/1	<0.19
Chromium	4.9	3.1	7/7	8.6	5.4	9/9	1.8
Lead	9 K	3.9	21/21	14.7 K	5.2	11/11	3.4
Selenium	0.33 J	0.19	5/7	<0.11	<0.11	0/1	<0.13
Xylenes	0.6	--	1/21	<0.1	--	0/3	

**Notes:**

J = Estimated. Analyte was present but the reported value may not be accurate or precise.

K = Analyte was present but the reported value may be biased high; the actual value is expected to be lower.

<sup>a</sup>Arithmetic mean concentrations are calculated using all values. Values below the detection level are assumed to be at one-half the detection level. Averages were not calculated if less than 50 percent of the samples were detected.

**MAXIMUM CONTAMINANT CONCENTRATIONS AND FREQUENCY OF DETECTION  
IN SITE INVESTIGATION SURFACE WATER AND SEDIMENT SAMPLES**  
**125TH FIGHTER INTERCEPTOR GROUP,**  
**FLORIDA AIR NATIONAL GUARD, JACKSONVILLE, FLORIDA**

Contaminant	Surface Water			Drainageways			Sediment			Downstream		
	Range of Detected Concentrations (µg/l)		Average <sup>a</sup> (µg/l)	Range of Detected Concentrations (µg/l)		Average <sup>a</sup> (µg/l)	Range of Detected Concentrations (mg/l)		Average <sup>a</sup> (mg/l)	Range of Detected Concentrations (mg/l)		Average <sup>a</sup> (mg/kg)
	Range of Detected Concentrations (µg/l)	Frequency	Average <sup>a</sup> (µg/l)	Range of Detected Concentrations (µg/l)	Frequency	Average <sup>a</sup> (µg/l)	Range of Detected Concentrations (mg/l)	Frequency	Average <sup>a</sup> (mg/l)	Range of Detected Concentrations (mg/l)	Frequency	
Arsenic	0.78 B - 4.3 J	2/4	1.44 BJ	1.4 J	1/2	0.78 J	0.49 J - 3.3	4/4	1.48 J	0.44 J - 0.5 J	2/2	0.47 J
Barium	35.4 J - 145 J	4/4	66.7 J	32.8 J - 40.3 J	2/2	36.55 J	23 J - 50.4	4/4	32.25 J	19.1 - 34.8	2/2	26.95
Cadmium	9.3 - 17.25	2/4	13.28	<1.6	0/2	--	0.37 J - 10.3	4/4	3.7 J	0.280 J	1/2	<0.22
Chromium	3.4 J - 122	3/4	52.42 J	<5.5	0/2	--	7.5 L - 119 L	4/4	46.55 L	4.5 - 6.0	2/2	5.25
Lead	4.2 - 41.9	4/4	27.34	2.5 B	1/2	2.5 B	5.1 L - 364 L	12/12	72 L	6.1-6.2	2/2	4.6
Mercury	0.68	1/4	--	0.35	1/2	0.21	0.13 JA	1/4	--	<0.1	0/2	--
Selenium	1.1 J	1/4	--	<1.1	0/2	--	0.16 J	1/4	--	<0.15	0/2	--
Silver	4.7 J	1/4	--	<6.7	0/2	--	<1.1	0/4	--	<0.94	--	<0.93
Trichlorofluoromethane			0/4				(µg/kg)					
Toluene	1,385 J	1/4	--				400 J - 600 J	4/12				
Ethyl Benzene	140 J	1/4	--				1,000	1/12				
Xylenes	685 J	1/4	--				1,000	1/12				
1,4-Dichlorobenzene	<1	0/4	--				200 - 6,500	3/12				
1,2-Dichlorobenzene	<1	0/4	--				100 J - 200 J	2/12				
Methyl-tert-butyl ether	99.5 J	1/4	--				800 J	1/12				
Benzene	460 J	1/4	--				<1	0/12				
Naphthalene	1,100	1/4	--				<1	0/12				
2-Methyl Naphthalene	155	1/4	--				1,600 J - 7,100	2/12				
							10,900	1/12				

Notes:

A = 0.6 µg/l in rinse blank.

B = Analyte was not detected above five times the value reported in the laboratory blank.

J = Estimated. Analyte was present but the reported value may not be accurate or precise.

L = Analyte was present but the reported value may be biased low. The actual value is expected to be higher.

<sup>a</sup>Arithmetic mean concentrations are calculated using all values. Values below the detection limit are assumed to be at one-half the detection level. Averages were not calculated if less than 50 percent of the samples were not detected.

**Table 6-4**  
**SITE CONTAMINANTS AND ASSOCIATED MEDIA**  
**125TH FIGHTER INTERCEPTOR GROUP,**  
**FLORIDA AIR NATIONAL GUARD, JACKSONVILLE, FLORIDA**

Contaminant	Groundwater	Soil	Surface Water	Sediment
Arsenic	X	X	X	X
Barium	X	X	X	X
Cadmium	X	X	X	X
Chromium	X	X	X	X
Lead	X	X	X	X
Mercury	X		X	X
Selenium	X	X	X	X
Silver			X	
Benzene	X		X	
Toluene	X		X	X
Ethyl Benzene	X		X	X
Xylene	X	X	X	X
Naphthalene	X		X	X
1-Methyl Naphthalene	X			
2-Methyl Naphthalene	X		X	X
Chlorobenzene	X			
Dichlorobenzene	X			X
Phenol			X	
4-Methyl Phenol	X			
Chloromethane	X			
Methylene Chloride	X			
1,1-Dichloroethane	X			
t-1,2 Dichloroethene	X			
Vinyl Chloride	X			
Chloroform			X	
Bromomethane				X
Trichlorofluoromethane				X
1,1,1 Trichloroethane	X			
Acetone	X			
2-Hexanone	X			
4-Methyl 2-Pentanone (MIBK)	X			
Benzoic Acid	X			
Polynuclear Aromatic Hydrocarbons				X
Bis(2-ethyl-hexyl)phthalate	X		X	X
Ethylene dibromide			X	

Table 6-5  
 CHEMICAL/PHYSICAL PROPERTIES OF SELECTED ORGANIC CHEMICALS  
 125TH FIGHTER INTERCEPTOR GROUP, FLORIDA AIR NATIONAL GUARD  
 JACKSONVILLE, FLORIDA

Chemical Name	CAS #	Mole Weight (g/mole)	Water Solubility (mg/l)	Vapor Pressure (mm Hg)	Henry's Law Constant (atm-m <sup>3</sup> /mol)	K <sub>oc</sub> (mL/g)	Log K <sub>ow</sub>	Fish BCF (l/kg)
Benzene	71-43-2	78	1.75E+03	9.52E+01	5.59E-03	83	2.12	5.2
Ethyl Benzene	100-41-4	106	1.52E+02	7.00E+00	6.43E-03	1100	3.15	37.5
Toluene	108-88-3	92	5.35E+02	2.81E+01	6.37E-03	300	2.73	10.7
Xylenes (mixed)	1330-20-7	106	1.98E+02	1.00E+01	7.04E-03	240	3.26	
1,1,1-Trichloroethane	71-55-6	133	1.50E+03	1.23E+02	1.44E-02	152	2.50	5.6
1,1-Dichloroethane	75-34-3	99	5.50E+03	1.82E+02	4.31E-03	30	1.79	
1,2-Dichloroethene (trans)	540-59-0	97	6.30E+03	3.24E+02	6.56E-03	59	0.48	1.6
Trichlorofluoromethane	75-69-4	137	1.10E+03	6.67E+02		159	2.53	
Vinyl Chloride	75-01-4	63	2.67E+03	2.66E+03	8.19E-02	57	1.38	1.17
1,2-Dichlorobenzene	95-50-1	147	1.00E+02	1.00E+00	1.93E-03	1700	3.60	56
1,3-Dichlorobenzene	541-73-1	147	1.23E+02	2.28E+00	3.59E-03	1700	3.60	56
1,4-Dichlorobenzene	106-46-7	147	7.90E+01	1.18E+00	2.89E-03	1700	3.60	56
Chlorobenzene	108-90-7	113	4.66E+02	1.17E+01	3.72E-03	330	2.84	10
Chloromethane	74-87-3	50	6.50E+03	4.30E+03	4.40E+02	35	0.95	-
Naphthalene	91-20-3	128	31.7	0.053	4.80E+04	962	3.30	95

**Table 6.6**  
**POTENTIAL EXPOSURE PATHWAYS**  
**125TH FIGHTER INTERCEPTOR GROUP,**  
**FLORIDA AIR NATIONAL GUARD, JACKSONVILLE, FLORIDA**

Source	Release/ Transport	Exposure Point	Exposure Route	Potential Receptors	Land Use	Retain Pathway	Rationale
Contaminated Surface Soil and Groundwater	Volatilization/Air	Onsite	Inhalation	Workers/ Visitors	Current	No	Low concentration of volatile constituents; paving and vegetative cover; site access is restricted. Primary releases to air are predominantly from ongoing facility activities.
Direct Contact with Soils	Onsite	Incidental Ingestion, Dermal Absorption	Workers	Current	Yes	Workers may occasionally perform routine maintenance in these areas.	
Leaching/ Groundwater	Onsite Wells	Ingestion, Dermal Absorption, and Inhalation	Workers	Current or Future	No	No uses currently exist for onsite shallow groundwater or are expected in the foreseeable future.	
Offsite Wells	Ingestion, Dermal Absorption, Inhalation	Workers	Future	Yes	Use of deep aquifer as a supply well is possible in this area.		
Groundwater/ Surface Runoff	Discharge to Drainageways	Dermal Absorption and Incidental Ingestion	Workers	Current	No	The nearest residences are 0.75 mile to the west, and regional Floridan aquifer groundwater appears to flow west to east. Onsite gradients are low, and shallow groundwater migrates toward the drainageways.	Site access is restricted; the drainageways do not have sufficient flow for recreational uses.

**Table 6-6**  
**(continued)**

Source	Release/ Transport	Exposure Point	Exposure Route	Potential Receptors	Land Use	Retain Pathway	Rationale
Groundwater/ Surface Runoff	Drainageways, Cedar Creek	Bioconcentra- tion and Ingestion	Aquatic Organisms	Current	Yes	Discharges occur and organisms are present.	
Cedar Creek	Ingestion of Fish	People Who Ingest Fish from Downstream	People Who Ingest Fish from Downstream	Current	Yes	People might fish in this area.	

**Table 6-7**  
**WELL INVENTORY INFORMATION**  
**125TH FIGHTER INTERCEPTOR GROUP,**  
**FLORIDA AIR NATIONAL GUARD, JACKSONVILLE, FLORIDA**

JBES <sup>a</sup> Refer. No.	Depth (ft)	Use	Comments
J1624	NA	Fire Protection	
J1625	650	Fire Protection	92 gpm yield
J1626	NA	Fire Protection	
J1627	NA	Fire Protection	May be plugged
J367	NA	NA	Floridan aquifer
D563	150	NA	
J2477	700	Irrigation	Drilled in 1980
J3170	660	Irrigation	33 gpm natural flow
J6073	13	Monitoring	2 wells near UST
J6162	10	Monitoring	3 wells at FANG
— <sup>b</sup>	1,200+	Public Supply	JIA Floridan aquifer well <sup>c</sup>
— <sup>b</sup>	1,200+	Public Supply	JIA Floridan aquifer well
— <sup>b</sup>	NA	Fire Protection	FANG fire protection well

<sup>a</sup>Information from Jacksonville Bio-Environmental Services (JBES) well inventory.

<sup>b</sup>Not included in JBES records. Information on these wells was obtained through interviews with FANG personnel.

<sup>c</sup>JIA = Jacksonville International Airport.

**Table 6-8**  
**REFERENCE DOSES AND CANCER POTENCY FACTORS**  
**USED IN RISK ASSESSMENT**  
**125TH FIGHTER INTERCEPTOR GROUP, FLORIDA AIR NATIONAL GUARD**  
**JACKSONVILLE, FLORIDA**

Contaminant	EPA Carcinogen Classification	Carcinogenic Potency Factor (kg-day/mg)	RfD (mg/kg/day)
Benzene	A	0.029	-
Ethyl Benzene	-	-	0.1
Naphthalene	-	-	0.4
Toluene	D	-	0.3
Xylenes	D	-	2
t-1,2-Dichloroethene			
1,1,1-Trichloroethane	-	-	0.09
1,1-Dichloroethane	C	0.091	0.009
Chloromethane	C	0.013	-
Trichlorofluoromethane	-	-	0.3
Vinyl Chloride	A	2.3	-
t-1,2-Dichloroethene	D	-	0.02
1,2-Dichlorobenzene	-	-	0.09
1,4-Dichlorobenzene	C	0.02	0.1
4-Methylphenol	-	-	0.5
Benzoic acid	-	-	4
Chlorobenzene	D	-	0.02
Arsenic	A	1.5	-
Barium	-	-	0.05
Cadmium	-	-	0.0005 X
Chromium III	-	-	1
Chromium VI	-	-	0.005
Lead	-	-	-
Mercury (alkyl and inorganic)	-	-	0.000158
Selenium	-	-	0.003

**Notes:**

X= Risk Assessment Is Under Review By An EPA Work Group. Health  
Advisories, NTIS, No. PB87-235586, March 1987, Give 0.0005 mg/kg/day.

Source of RfDs: Integrated Risk Information System (EPA, 1990).

**Table 6-9**  
**TOXICOLOGICAL PROFILES FOR HUMAN HEALTH EFFECTS**  
**125TH FIGHTER INTERCEPTOR GROUP,**  
**FLORIDA AIR NATIONAL GUARD, JACKSONVILLE, FLORIDA**

Chemical	Acute Toxicity Summary <sup>a</sup>	Chronic Toxicity Summary <sup>a</sup>	Cancer Potential	Other
Arsenic	Acute oral exposure can cause muscular cramps, facial swelling, cardiovascular reactions, severe gastrointestinal damage, and vascular collapse leading to death. Sensory loss and hematopoietic symptoms delayed after exposure to high concentrations are usually reversible. Inhalation exposures can cause severe irritation of nasal lining, larynx, and bronchi.	Chronic oral or inhalation exposure can produce changes in skin, including hyperpigmentation and hyperkeratosis; peripheral neuropathy; liver injury; cardiovascular disorders; oral exposures associated with peripheral vascular disease, blackfoot disease.	Known human carcinogen; oral exposures associated with skin and liver cancer, inhalation exposures with lung cancer.	May be essential. Toxicity varies for different compounds; inorganic trivalent arsenic compounds usually more toxic than pentavalent compounds; high doses of some inorganic arsenic compounds to pregnant laboratory animals produced malformations in offspring.
Barium	Ingestion of barium salts can cause prolonged muscular stimulation; gastroenteritis; hypokalemia; and cardiovascular effects such as ventricular fibrillation and extra systoles.	Prolonged occupational inhalation has resulted in barotisis--a benign, reversible pneumoconiosis.	Not applicable.	Toxicity of compounds depends on solubility.
Benzene	Acute exposures (inhalation) to high levels of benzene may lead to depression of the central nervous system, unconsciousness, and death, or may cause fatal cardiac arrhythmias.	Major toxic effect is hematopoietic toxicity (affects formation of blood); chronic exposure of workers to low levels has been associated with blood disorders such as leukemia and aplastic anemia (depression of all three cell types of the blood in absence of functioning marrow).	Sufficient evidence that it is a human and animal carcinogen; strong correlation between exposure to benzene by inhalation and leukemia.	Chromosomal aberrations in bone marrow and blood have been reported in experimental animals and some workers.
1,1-Dichloro-ethane	CNS depression may occur when 1,1-dichloroethane is inhaled at high concentrations. Irritating to skin.			
trans-1,2-Dichloro-ethylene	Inhalation exposure to high levels can cause narcosis and death in rats.	Rats exposed by inhalation exhibited fatty accumulation in liver and infiltration of lungs.		

**Table 6-9 (Continued)**

Chemical	Acute Toxicity Summary <sup>a</sup>	Chronic Toxicity Summary <sup>a</sup>	Cancer Potential	Other
Cadmium	For acute exposures by ingestion, symptoms of cadmium toxicity include nausea, vomiting, diarrhea, muscular cramps, salivation, spasms, drop in blood pressure, vertigo, loss of consciousness, and collapse. Acute renal failure, liver damage, and death may occur. Exposure by inhalation can cause irritation, coughing, labored respiration, vomiting, acute chemical pneumonitis, and pulmonary edema.	Respiratory and renal toxicity are major effects in workers. Chronic oral exposures can produce kidney damage. Cadmium accumulates in kidney, and nephropathy results after critical concentration in kidney is reached, probably about 200 µg/g. Inhalation can cause chronic obstructive pulmonary disease, including bronchitis, progressive fibrosis, and emphysema. Chronic exposure affects calcium metabolism and can cause loss of calcium from bone, bone pain, osteomalacia, and osteoporosis. Chronic exposure may be associated with hypertension. Cadmium can produce testicular atrophy, sterility, and teratogenic effects in experimental animals.	Increased risk of prostate cancer and perhaps respiratory tract cancer in workers exposed by inhalation. No evidence of carcinogenicity from chronic oral exposure.	A nonessential element.
Chromium	Major acute effect from oral exposure is renal tubular necrosis. Inhalation of chromate salts results in irritation and inflammation of nasal mucosa, ulceration, and perforation of nasal septum.	Chronic exposure to hexavalent chromium has resulted in kidney damage in animals and humans. Inhalation exposures to chromates in industrial settings have resulted in nasal membrane inflammation, chronic rhinitis, laryngitis, and pharyngitis. Exposures to skin can result in allergic skin reactions in sensitive individuals. Overall, hexavalent forms are usually more toxic than trivalent forms.	Excess lung cancer has been associated with chromate-producing industry workers. Chromate salts are carcinogenic in rats exposed by inhalation.	Essential element. Toxicity is related to valence state.
Ethyl Benzene	Ethyl benzene is irritating to eyes, mucous membranes, and skin. It can cause headaches and narcosis.			

**Table 6-9 (Continued)**

Chemical	Acute Toxicity Summary <sup>a</sup>	Chronic Toxicity Summary <sup>a</sup>	Cancer Potential	Other
<b>Lead</b>	Acute inorganic lead intoxication in humans is characterized by encephalopathy, abdominal pain, hemolysis, liver damage, renal tubular necrosis, seizures, coma, and respiratory arrest.	Chronic low levels of exposure to lead can affect the hematopoietic system, the nervous system, and the cardiovascular system. Lead inhibits several key enzymes involved in hemebiosynthesis. One characteristic effect of chronic lead intoxication is anemia by reduced hemoglobin production and shortened erythrocyte survival. In humans, lead exposure has resulted in nervous system injury including reduced hand-eye coordination, reaction time, visual motor performance, and nerve conduction velocity. The developing child appears especially sensitive to lead-induced nervous system injury. Lead can also affect the immune system and produce gingival lead lines. Epidemiological studies have indicated that chronic lead exposure may be associated with increased blood pressure in humans. Exposure to lead is associated with sterility, abortion, neonatal mortality, and morbidity. Organolead compounds are neurotoxic.	Lead salts have some evidence of carcinogenicity in animals.	Children are especially sensitive to low level effects.
<b>Mercury</b>	Inhalation of mercury vapor can cause bronchitis and nervous system effects. Oral exposure can result in abdominal cramps, gastrointestinal effects, ulceration, shock, circulatory collapse, and renal failure.	Occupational exposure to inorganic mercury can produce effects on nervous system, including tremors, erythema, muscular weakness, personality changes, gingivitis, and colored eye reflex. In children, pink disease has been reported after ingestion of mercurous compounds. Exposure to organic mercury can cause sensory and visual disturbances, tingling, paresthesiae, numbness, tunnel vision leading to blindness, weakness in extremities and progressive ataxia, tremor, cerebral atrophy, and degeneration of nerves; visual, peripheral neuropathy; and death.	Mercury crosses placenta. Toxicity depends on chemical form. Metallic, organic, and inorganic compounds can be biotransformed.	

**Table 6-9 (Continued)**

Chemical	Acute Toxicity Summary <sup>a</sup>	Chronic Toxicity Summary <sup>a</sup>	Cancer Potential	Other
Toluene	Humans exposed by inhalation experimentally or occupationally or by intentional abuse may exhibit excitation, then CNS depression and necrosis; neurotoxic effects include nausea, fatigue, and incoordination at low levels and confusion, ataxia, and weakness at higher levels; in rats, irritation of mucous membranes and incoordination have been observed, as well as pulmonary irritation with subchronic exposure.	CNS effects have been reported in workers, such as disturbances in memory and thinking, psychomotor skills, visual accuracy, sensorimotor speed, and performance tests; indications of cerebral and cerebellar dysfunction include tremors, ataxia, and equilibrium disorders; bizarre behavior and emotional lability may occur. In cases of abuse, changes in liver and kidney function have been observed. In rats, a decrease in hematocrit has been reported.	Embryotoxicity and possible teratogenicity in mice have been reported in an abstract; in rats, skeletal retardation of offspring has been described.	
1,1,1-Trichloroethane	Trichloroethane is a central nervous system depressant and may impair psychophysiological functions. Human fatalities have been reported following deliberate inhalation or occupational exposures; lung congestion was found.	Exposure by inhalation can produce liver damage in mice and affects drug metabolism in liver of rats.	Mutagenic in some <i>in vitro</i> tests.	Vinyl chloride is mutagenic in several test systems.
Vinyl Chloride	Acute occupational exposure to high concentrations of vinyl chloride can produce symptoms of narcosis in humans. Respiratory tract irritation, bronchitis, headache, irritability, memory disturbances, and tingling sensations may also occur. Deaths have been reported. In animals, ataxia, narcosis, blood clotting difficulties, congestion and edema in lungs, and kidney and liver effects have been demonstrated; at high doses, excitement, contractions, convulsions, and an increase in respiration followed by respiratory failure precede death.	Human health effects associated with chronic occupational exposure to vinyl chloride include hepatitis-like liver changes, decreased blood platelets, enlarged spleens, decreased pulmonary function, acroosteolysis (sometimes with Raynaud-like syndrome), sclerotic syndrome, thrombocytopenia, cardiovascular and gastrointestinal toxicity, and disturbances in vision and in the central nervous system. In laboratory animals, the liver and kidney toxicity may be severe and histopathological changes in lung and spleen may also occur with vinyl chloride exposure.	Vinyl chloride is a known human carcinogen causing liver angiosarcomas (a very rare tumor in humans) and possibly increasing incidence of tumors of the brain, lung, and hemolymphopoietic system in humans. Vinyl chloride is carcinogenic in mice, rats, and hamsters.	Chromosome aberrations have been reported in exposed workers. In humans, possible relationships between exposure and birth defects and fetal death have been reported; possible increased fetal mortality among wives of occupationally exposed workers has been debated; increased skeletal variants were found in offspring of mice exposed during gestation.

**Table 6-9 (Continued)**

Chemical	Acute Toxicity Summary <sup>a</sup>	Chronic Toxicity Summary <sup>a</sup>	Cancer Potential	Other
Xylene	Acute exposures to inhaled xylene can depress the central nervous system and irritate mucous membranes.	Changes in behavioral tests, manual coordination, balance, and electroencephalographic patterns have been reported in humans exposed to xylenes; development of tolerance against some of these effects has been described. Effects on liver of rats have been reported.		

<sup>a</sup>Health effect or target organ may be based on animal studies and does not imply that the results of exposure to humans will be the same.

Sources:

- Documentation of the Threshold Limit Values. American Conference of Governmental Industrial Hygienists, Inc. (1980, 1984). Toxicology, 3rd edition, C.D. Klaassen, M.O. Andur, and J. Doull, eds., Macmillan Publishing Co., New York (1986). Monographs, Vol. 3, 20, 23, International Agency for Research on Cancer, Lyon, France (1973, 1979, 1980). Drinking Water and Health, Vol. 1, National Academy of Sciences (1977). Handbook of Toxic and Hazardous Chemicals, M. Sittig, Noyes Publications, Park Ridge, New Jersey (1981). EPA health advisories for inorganics, organics, and pesticides (March 1987). Experimental and Clinical Neurotoxicology, P.S. Spencer and H.H. Schaumburg, eds. Williams and Wilkins, Baltimore (1980). Pesticides Studied in Man, W.J. Hayes, Williams and Wilkins, Baltimore (1982). 29 CFR 1910.50412-50459, December 10, 1985; OSHA, Occupational Exposure to Formaldehyde. 40 CFR 141.25720-25734, July 8, 1987, EPA, Drinking Water.

Table 6-10  
 NON-CARCINOGENIC RISKS FROM SOIL INGESTION EXPOSURE AT FANG  
 125TH FIGHTER INTERCEPTOR GROUP, FLORIDA AIR NATIONAL GUARD  
 JACKSONVILLE, FLORIDA

Contaminant	Reference Dose (RfD) (mg/kg/day)	Maximum Concentration (C) (ug/kg)	Average Daily Intake (mg/kg/day)	Average Intake/RfD	Intake Exceeds RfD?
Arsenic		1200 K			
Barium	0.05	51900	2.00E-07	4.00E-06	No
Cadmium	0.0005	620	3.00E-09	6.00E-06	No
Chromium VI	0.005	8600	4.00E-08	8.00E-06	No
Lead		14700 K	2.00E-08		
Selenium	0.003	330 J	2.00E-09	7.00E-07	No
Xylenes	2	600	3.00E-09	1.00E-09	No
<b>Hazard Index (Sum of Intake/RfD)</b>				<b>2.00E-05</b>	

**Exposure Assumptions**

Exposed Individual	Adult Worker
Soil Intake (IR) (mg/day)	10
Body Weight (BW) (kilograms)	70
Exposure Frequency (EF) (days/year)	12
Exposure Duration (ED) (years)	40
Conversion Factor (CF) (kg/ug)	1.00E-09
Averaging Time (AT)	(365 days/year) (ED)

**Exposure Formula:**  $\text{Intake} = \frac{(C)(IR)(CF)(EF)(ED)}{(BW)(AT)}$

Source of RfDs: Integrated Risk Information System (EPA, 1990)

**Notes:**

J = Estimated. Analyte Was Present But The Reported Value May Not Be Accurate Or Precise.

K = Analyte Was Present But The Reported Value May Be Biased High; The Actual Value Is Expected To Be Lower.

**Table 6-11**  
**NON-CARCINOGENIC RISKS FROM DERMAL ABSORPTION FROM SOILS:**  
**MAXIMUM CONCENTRATIONS FROM ALL SITES**  
**125TH FIGHTER INTERCEPTOR GROUP, FLORIDA AIR NATIONAL GUARD**  
**JACKSONVILLE, FLORIDA**

Contaminant	Reference Dose (RfD) (mg/kg/day)	Maximum Concentration (C) (ug/kg)	Average Chronic Daily Intake (mg/kg/day)	Intake/RfD	Intake Exceeds RfD?
Arsenic		1200 K	2.40E-08		
Barium	0.05	51900	1.00E-06	2.00E-05	No
Cadmium	0.0005	620	1.20E-08	2.00E-05	No
Chromium VI	0.005	8600	1.70E-07	3.00E-05	No
Lead		14700 K	2.90E-07		
Selenium	0.003	330 J	6.60E-09	2.00E-06	No
Xylenes	2	600	1.20E-07	6.00E-08	No
<b>Hazard Index (Sum of Intake/RfD)</b>				<b>7.21E-05</b>	

**Exposure Assumptions**

Exposed Individual	Adult Worker
Exposed Skin Area (SA) (sq cm/day)	2940
Skin Adherence Factor (AF) (mg/sq cm)	1.45
Absorption Factor (ABS)	1% Metals 10% Organic Compounds
Exposure Frequency (EF) (days/year)	12
Exposure Duration (ED) (years)	40
Body Weight (BW) (kg)	70
Averaging Time (AT)	(365 days/year) (ED)
Conversion Factor (CF) (kg/ug)	1.00E-09

**Exposure Formula:**      
$$\text{Intake} = \frac{(C)(SA)(AF)(ABS)(EF)(ED)(CF)}{(BW)(AT)}$$

Source of RfDs: Integrated Risk Information System (EPA, 1990)

**Notes:**

**J** = Estimated. Analyte Was Present But The Reported Value May Not Be Accurate Or Precise.

**K** = Analyte Was Present But The Reported Value May Be Biased High; The Actual Value Is Expected To Be Lower.

**Table 6-12**  
**EXCESS LIFETIME CANCER RISK FROM**  
**SOIL INGESTION EXPOSURE AT FANG**  
**125TH FIGHTER INTERCEPTOR GROUP, FLORIDA AIR NATIONAL GUARD**  
**JACKSONVILLE, FLORIDA**

Contaminant	EPA Carcinogen Classification	Carcinogenic Potency Factor (kg-day/mg)	Concentration (C) (ug/kg)	Lifetime Average Chemical Intake (mg/kg/day)	Excess Lifetime Cancer Risk
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Arsenic	A	1.5	1200 K	3.20E-09	5.00E-09
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**Exposure Assumptions**

Exposed Individual	Adult Worker
Soil Intake (IR) (mg/day)	0.01
Body Weight (BW) (kilograms)	70
Exposure Frequency (EF) (days/year)	12
Exposure Duration (ED) (years)	40
Conversion Factor (CF) (kg/ug)	1.00E-09
Averaging Time (AT)	(70 years) (365 days/year)

**Exposure Formula:**      
$$\text{Intake} = \frac{(C)(IR)(CF)(EF)(ED)}{(BW)(AT)}$$

**Source of Carcinogenic Potency Factors: Integrated Risk Information System (EPA, 1990).**

**Note:**

**K = Analyte Was Present But The Reported Value May Be Biased High; The Actual Value Is Expected To Be Lower.**

**Table 6-13**  
**EXCESS LIFETIME CANCER RISK FROM**  
**DERMAL ABSORPTION OF SOILS AT FANG**  
**125TH FIGHTER INTERCEPTOR GROUP, FLORIDA AIR NATIONAL GUARD**  
**JACKSONVILLE, FLORIDA**

Contaminant	EPA Carcinogen Classification	Carcinogenic Potency Factor (kg-day/mg)	Concentration (C) (ug/kg)	Lifetime Average Chemical Intake (mg/kg/day)	Excess Lifetime Cancer Risk
Arsenic	A	1.5	1200 K	1.40E-08	2.00E-08
<b>Exposure Assumptions</b>					
Exposed Individual					Adult Worker
Exposed Skin Area (SA) (sq cm/day)					2940
Skin Adherence Factor (AF) (mg/sq cm)					1.45
Absorption Factor (ABS)					1 % Metals 10 % Organic Compounds
Exposure Frequency (EF) (days/year)					12
Exposure Duration (ED) (years)					40
Body Weight (BW) (kg)					70
Averaging Time (AT)					(70) (365 days/year)
Conversion Factor (CF) (kg/ug)					1.00E-09
Exposure Formula:		Intake = $\frac{(C)(SA)(AF)(ABS)(EF)(ED)(CF)}{(BW)(AT)}$			

Source of Carcinogenic Potency Factors: Integrated Risk Information System (EPA, 1990).

Note:

K = Analyte Was Present But The Reported Value May Be Biased High; The Actual Value Is Expected To Be Lower.

Table 6-14  
 COMPARISON OF GROUNDWATER AND SURFACE WATER  
 MAXIMUM CONCENTRATIONS WITH FEDERAL AMBIENT WATER QUALITY CRITERIA  
 125TH FIGHTER INTERCEPTOR GROUP, FLORIDA AIR NATIONAL GUARD  
 JACKSONVILLE, FLORIDA

Compound	Maximum	Maximum	Maximum	FAWQC for Protection of Human Health	
	Groundwater Concentration (ug/l)	Surface Water Concentration (ug/l)	Downstream Concentration (ug/l)	From Ingestion Of Fish (ug/l) Toxicity Protection	10 - 6 Cancer Risk
Benzene	60	460 J	<1		40
Ethyl Benzene	150	140 J	<1	3280	
Toluene	39	1385 J	<1	424000	
Xylenes (total)	430	685 J	<1		
Methyl-tert-butyl ether	45	99.5 J	<1		
1,1,1-Trichloroethane	1	<1	<1	1030000	
trans-1,2-Dichloroethene	24	<1	<1		
Vinyl chloride	4	<1	<1		525
1,2-Dichlorobenzene (o)	34	<1	<1	2600	
1,3-Dichlorobenzene (m)	6	<1	<1	2600	
1,4-Dichlorobenzene (p)	34	<1	<1	2600	
4-Methylphenol	210	<1	<1		
Chlorobenzene (mono)	35	<1	<1	15050	
1,1-Dichloroethane	13	<1	<1		
Naphthalene	26	1100	<1		
2-Methyl Naphthalene	44	155	<1		
Arsenic	9.2	4.3 J	1.4 J		0.0175
Barium	574	145 J	40.3 J		
Cadmium	4.5	17.25	<1.6		
Chromium (total)	152	90.45	<5.5		
Chromium (hexavalent)					
Chromium (trivalent)				3433000	
Lead	1200	41.5	2.5 B		
Mercury	0.53	0.68	0.35	0.146	
Selenium	1.5	1.1 J	<1.1		
Silver	<4.4	4.7 J	<6.7		

Note:

J=Estimated. Analyte Was Present But The Reported Value May Not Be Accurate or Precise.

**Table 6-15**  
**NON-CARCINOGENIC RISKS FROM POTENTIAL FUTURE**  
**GROUNDWATER INGESTION EXPOSURE AT FANG**  
**125TH FIGHTER INTERCEPTOR GROUP, FLORIDA AIR NATIONAL GUARD**  
**JACKSONVILLE, FLORIDA**

Contaminant	Reference Dose (RfD) (mg/kg/day)	Estimated (a)		Intake/ RfD	Intake Exceeds RfD?
		Maximum Concentration (C) (ug/l)	Daily Intake (mg/kg/day)		
Ethyl Benzene	0.1	0.6 J	6.00E-06	6.00E-05	No
Naphthalene	0.4	0.36	3.00E-06	8.00E-06	No
Toluene	0.3	0.16	2.00E-06	7.00E-06	No
Xylenes	2	1.72	2.00E-05	1.00E-05	No
1,1,1-Trichloroethane	0.09	0.004	4.00E-08	4.00E-07	No
1,1-Dichloroethane	0.009	0.05 J	5.00E-07	6.00E-05	No
t-1,2-Dichloroethene	0.02	0.1 MJ	9.00E-07	4.00E-05	No
1,2-Dichlorobenzene	0.09	0.14	1.00E-06	1.00E-05	No
1,4-Dichlorobenzene	0.1	0.07	7.00E-07	7.00E-06	No
4-Methyl Phenol	0.5	0.84	8.00E-06	2.00E-05	No
Benzoic Acid	4	5.2 J	5.00E-05	1.00E-05	No
Chlorobenzene	0.02	0.14	1.00E-06	5.00E-05	No
Arsenic		0.04 J	4.00E-07		
Barium	0.05	2.3	2.00E-05	4.00E-04	No
Cadmium	0.0005	0.02 J	2.00E-07	4.00E-04	No
Chromium VI	0.005	0.61	6.00E-06	1.00E-03	No
Lead		4.8 J	5.00E-05		
Mercury (alkyl and inorganic)	0.0003	0.002 J	2.00E-08	7.00E-05	No
Selenium	0.003	0.006 J	6.00E-08	2.00E-05	No
<b>Hazard Index (Sum of Intake/RfD)</b>				<b>2.00E-03</b>	

**Exposure Assumptions**

Exposed Individual	Adult Worker
Water Intake (IR) (liters/day)	1
Body Weight (BW) (kilograms)	70
Exposure Duration (ED) (years)	40
Exposure Frequency (EF) (days/year)	240
Averaging Time (AT)	(365 days/year) (ED)

Exposure Formula: 
$$\text{Intake} = \frac{(C)(IR)(ED)(EF)}{(BW)(AT)}$$

Source of RfDs: Integrated Risk Information System (EPA, 1990).

**Notes:**

- (a) = Estimated Concentration For Well Placed In The Deep Aquifer (See Section 6.2).
- J = Estimated. Analyte Was Present But The Reported Value May Not Be Accurate Or Precise.
- M = Total 1,2-Dichloroethene.

**Table 6-16**  
**EXCESS LIFETIME CANCER RISK FROM**  
**GROUNDWATER INGESTION EXPOSURE AT FANG**  
**125TH FIGHTER INTERCEPTOR GROUP, FLORIDA AIR NATIONAL GUARD**  
**JACKSONVILLE, FLORIDA**

Contaminant	EPA Carcinogen Classification	Carcinogenic Potency Factor (kg-day/mg)	Maximum Concentration (C) (ug/l)	Lifetime Average Chemical Intake (mg/kg/day)	Estimated (a) Excess Lifetime Cancer Risk
<b>SITE 1</b>					
Arsenic	A	1.5	0.04	2E-07	3E-07
Benzene	A	0.029	0.16	9E-07	3E-08
<b>Sum of Risks</b>					<u>3E-07</u>
<b>SITE 2</b>					
Benzene	A	0.029	0.02	1E-07	<u>3E-09</u>
<b>Sum of Risks</b>					<u>3E-09</u>
<b>SITE 3</b>					
Arsenic	A	1.5	0.024	1E-07	2E-07
Benzene	A	0.029	0.14	8E-07	2E-08
1,1-Dichloroethane	C	0.091	0.05	3E-07	<u>3E-08</u>
<b>Sum of Risks</b>					<u>2E-07</u>
<b>SITE 4</b>					
Arsenic	A	1.5	0.021	1E-07	2E-07
Benzene	A	0.029	0.02	1E-07	<u>3E-09</u>
<b>Sum of Risks</b>					<u>2E-07</u>
<b>SITE 5</b>					
Arsenic	A	1.5	0.011	6E-08	9E-08
Benzene	A	0.029	0.24	1E-06	4E-08
Chloromethane	C	0.013	0.004	2E-08	<u>3E-10</u>
<b>Sum of Risks</b>					<u>3E-07</u>
<b>SITE 6</b>					
Arsenic	A	1.5	0.004	2E-08	3E-08
Chloromethane	C	0.013	0.004	2E-08	<u>3E-10</u>
<b>Sum of Risks</b>					<u>3E-08</u>
<b>SITE 8</b>					
Arsenic	A	1.5	0.012	6E-08	1E-07
Benzene	A	0.029	0.104	6E-07	2E-08
Vinyl chloride	A	2.3	0.004	2E-08	<u>5E-08</u>
<b>Sum of Risks</b>					<u>2E-07</u>
<b>Exposure Assumptions</b>					
Exposed Individual				Adult Worker	
Water Intake (IR) (liters/day)				1	
Body Weight (BW) (kilograms)				70	
Exposure Duration (ED) (years)				40	
Exposure Frequency (EF) (days/year)				240	
Averaging Time (AT)				(70) (365 days/year)	
Exposure Formula:				Intake = $\frac{(C)(IR)(ED)(EF)}{(BW)(AT)}$	

Source of Carcinogenic Potency Factors: Integrated Risk Information System (EPA, 1990).

Notes:

- (a) = Estimated Concentration For Well Placed In The Deep Aquifer (See Section 6.2).
- J = Estimated. Analyte Was Present But The Reported Value May Not Be Accurate Or Precise.
- M = Total 1,2-Dichloroethene.

**Table 6-17**  
**ENDANGERED/THREATENED OR POTENTIALLY ENDANGERED/THREATENED PLANTS**  
**THAT OCCUR OR MAY OCCUR AT JACKSONVILLE INTERNATIONAL AIRPORT, DUVAL COUNTY, FLORIDA**  
**125TH FIGHTER INTERCEPTOR GROUP,**  
**FLORIDA AIR NATIONAL GUARD, JACKSONVILLE, FLORIDA**

Scientific Name	Common Name	Designated Status			Likelihood of Occurrence
		FWS <sup>a</sup>	CITES <sup>b</sup>	FDA <sup>c</sup>	
<i>Cheilanthes microphylla</i> (S.W.) SW.	Southern Lip Fern			R	L
<i>Lilium catesbaei</i> Walter	Pine Lily	T			P
<i>Osmunda regalis</i> L. var. <i>specabilis</i>	Royal Fern	C			P
<i>Peltandra sagittifolia</i> (Michx.) Morong	Spoon Flower		R		M
<i>Platanthera cristata</i> Michx.	Crested Fringed Orchid			T	M
<i>Rhipidophyllum hystrix</i> (Pursh)	Needle Palm	URS	II	C	P
Wendl and Drude					
<i>Rhododendron canescens</i> (Michx.) Sweet	Wild Azalea		C		P
<i>Salvinia minima</i> Baker	Water Fern		T		P
<i>Sarracenia minor</i> Walt	Pitcher Plant		T		P
<i>Smilax smallii</i> Morong	Jackson Vine			M	
<i>Woodwardia areolata</i> (L.) Moore	Netted Chain Fern	T		P	

<sup>a</sup>U.S. Fish and Wildlife Service, 1988.

<sup>b</sup>Convention on International Trade in Endangered Species of Wild Fauna & Flora, 1973.

<sup>c</sup>Florida Department of Agriculture and Consumer Services, 1987 (Lists published in Section 39-27-03-05, FAC),  
<sup>d</sup>Florida Committee on Rare and Endangered Plants and Animals (Pritchard, 1978-1979). Hunter/RS&H, 1987-88.

Key:

- R = Rare; T = Threatened; C = Commercially Exploited; II = Appendix II species of (CITES).
- URS = Still formally under review for listing, but no longer considered for listing because recent information indicates species is more widespread or abundant than previously believed.
- L = Low; occurrence of an important plant species within or near property boundaries is highly unlikely because of species' range or unsuitable habitat or both.
- M = Moderate; important plant species may occur onsite because range and suitable habitat exist within property boundaries.
- H = High; there is a very good possibility that an important plant species exists within property boundaries because range and habitat for the species are found onsite.
- P = Present; the plant species was observed at the site during surveys.

**PROTECTED VERTEBRATE SPECIES OBSERVED OR POTENTIALLY OCCURRING ON JACKSONVILLE  
INTERNATIONAL AIRPORT PROPERTY, DUVAL COUNTY, FLORIDA**  
**125TH FIGHTER INTERCEPTOR GROUP,  
FLORIDA AIR NATIONAL GUARD, JACKSONVILLE, FLORIDA**

Scientific Name	Common Name	Status		Comments
		FGFWFC <sup>a</sup>	FWS <sup>b</sup>	
<b>AMPHIBIANS AND REPTILES</b>				
<u>Alligator mississippiensis</u>	American Alligator	SSC	T(S/A)	Occurs throughout Florida wetlands. Observed in field.
<u>Ambystoma cingulatum</u>	Flatwoods Salamander	--	UR2	May occur in slash pine flatwoods or near cypress swamps located onsite. Not observed during field visit. Unlikely to occur along drainageway.
<u>Drymarchon corais couperi</u>	Eastern Indigo Snake	T	T	May use various habitat types on property. May use gopher tortoise burrows for shelter. Not observed in field.
<u>Gopherus polyphemus</u>	Gopher Tortoise	SSC	UR2	Nineteen active burrows observed in field. No burrows observed in vicinity of drainageway.
<u>Pituophis melanoleucus mugitus</u>	Florida Pine Snake	SSC	UR2	May occur in stands of oak or pine or abandoned fields. Not likely to use property because of lack of pocket gophers, a major food source.

**Table 6-18**  
**(Continued)**

Scientific Name	Common Name	Status		Comments
		FGFWFC <sup>a</sup>	FWS <sup>b</sup>	
<u>Rana areolata</u>	Gopher Frog	SSC	UR2	May use gopher tortoise burrows. Not expected to occur in significant numbers because of scarcity of gopher tortoises.
<b>MAMMALS</b>				
<u>Plecotus rafinesquii</u>	Southeastern Big-Eared Bat	--	UR2	Prefers heavily forested regions. Will roost in dilapidated buildings and hollow trees. Rare in Florida, unlikely to occur on property.
<u>Sciurus niger shermani</u>	Sherman's Fox Squirrel	SSC	UR2	Observed in field. Potential habitats are suboptimal. Unlikely to use drainageway.
<u>Ursus americanus floridanus</u>	Florida Black Bear	T	UR2	Not observed in field. Not likely to occur because of urbanization and disturbance of habitats.
<b>BIRDS</b>				
<u>Aimophila gestivalis</u>	Bachman's Sparrow	--	UR2	Inhabits open pine or oak woods, palmetto scrub, bushy pastures. Habitat along drainageway unsuitable.

**Table 6-18**  
(Continued)

Scientific Name	Common Name	Status		Comments
		FGFWFC <sup>a</sup>	FWs <sup>b</sup>	
<i>Aramus guarauna</i>	Limpkin	SSC	--	Not expected to use property extensively because of scarcity of apple snails, the major food source.
<i>Dendroica kirtlandii</i>	Kirtland's Warbler	E	E	Migrates along eastern coast of Florida. Unlikely to occur.
<i>Egretta caerulea</i>	Little Blue Heron	SSC	--	May feed in shallow wetlands and drainageway. No rookeries observed.
<i>Egretta thula</i>	Snowy Egret	SSC	--	May feed in wetlands and drainageway. Not likely to nest because of lack of suitable vegetation.
<i>Egretta tricolor</i>	Tri-colored Heron	SSC	--	May occasionally feed in wetlands, although available habitat types are not preferred.
<i>Elanoides forficatus</i>	Swallow-Tailed Kite	--	UR2	May feed in cypress and hardwood swamps. Not observed.
<i>Falco peregrinus tundrius</i>	Arctic Peregrine Falcon	E	T	May hunt in open areas during stopover in winter migration route.
<i>Falco sparverius paulus</i>	Southeastern American Kestrel	T	UR2	May hunt in open areas near roadways and clearings.

**Table 6-18**  
**(Continued)**

Scientific Name	Common Name	Status		Comments
		FGFWFC <sup>a</sup>	FWS <sup>b</sup>	
<u><i>Haliaeetus leucocephalus</i></u>	Bald Eagle	T	E	No nests observed on field visit. Not likely to feed in small ponds or drainageway.
<u><i>Mycteria americana</i></u>	Wood Stork	E	E	May feed in cypress swamps and freshwater marshes. Closest nesting colony located over 10 miles east of property.
<u><i>Pandion haliaetus</i></u>	Osprey	SSC	--	Water bodies on property are not expected to support large fish populations necessary for feeding. No nests observed on property.
<u><i>Picooides borealis</i></u>	Red-Cockaded Woodpecker	T	E	Inhabits mature pine flatwoods. No suitable habitat on property.
<u><i>Vermivora bachmanii</i></u>	Bachman's Warbler	E	E	Property within historic migration route. Not expected to occur on property.

<sup>a</sup>Florida Game and Fresh Water Fish Commission, 1987.

<sup>b</sup>U.S. Fish and Wildlife Service, 1987.

Key: T = Threatened; T(S/A) = Threatened by Similarity of Appearance; E = Endangered; SSC = Species of Special Concern;  
URS = Under review for listing, but substantial evidence of biological vulnerability and/or threat is lacking.

Hunter/RS&H, 1988.

**Table 6-19**  
**CONSTITUENTS DETECTED IN SURFACE WATERS**  
**IN EXCESS OF WATER QUALITY CRITERIA**  
**125TH FIGHTER INTERCEPTOR GROUP,**  
**FLORIDA AIR NATIONAL GUARD, JACKSONVILLE, FLORIDA**

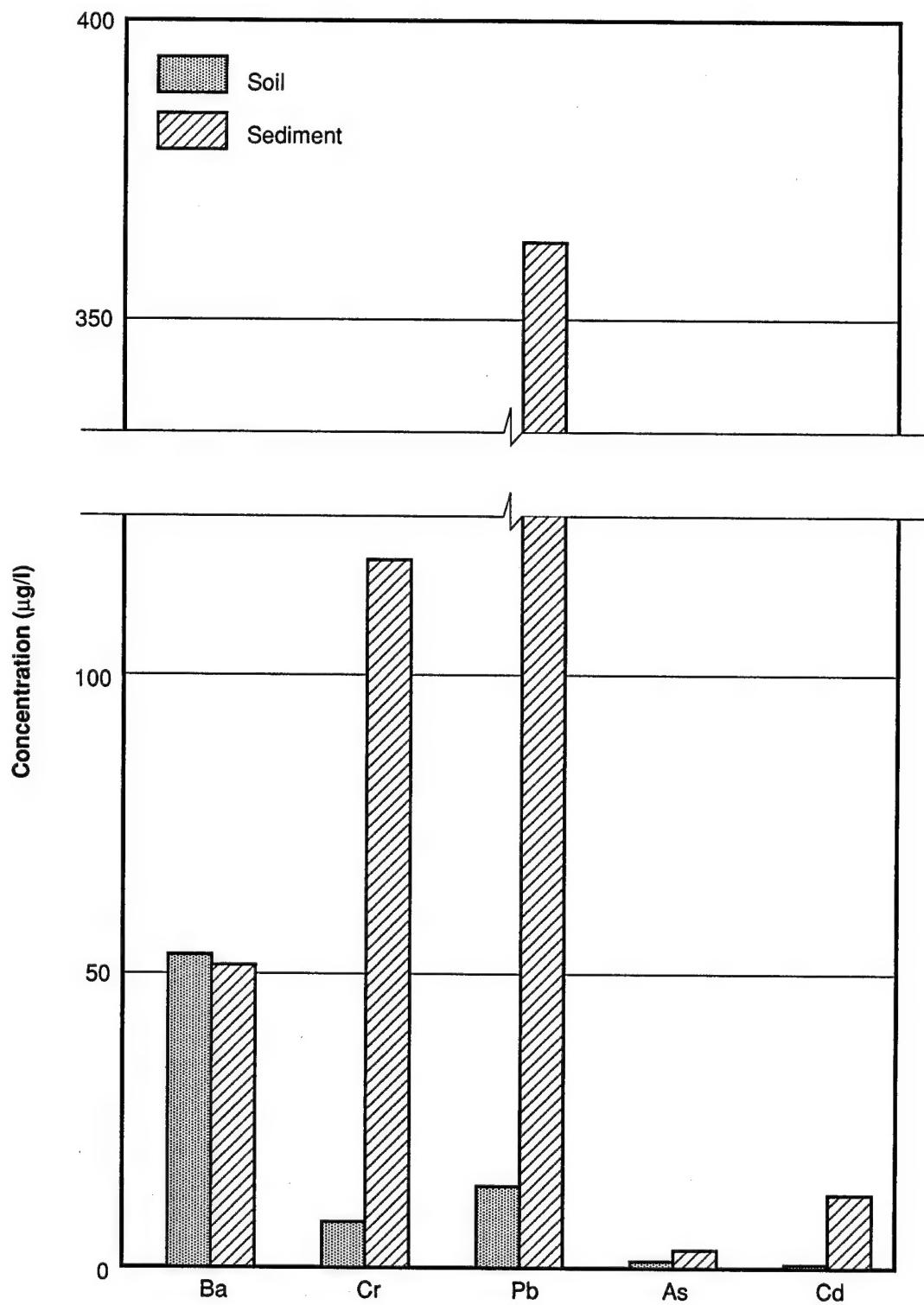
Constituent	Maximum Concentration ( $\mu\text{g/l}$ )	Average Concentration ( $\mu\text{g/l}$ )	Class III Surface Water Quality Criteria ( $\mu\text{g/l}$ )	Ambient Water Quality Criteria for Freshwater Organisms ( $\mu\text{g/l}$ ) <sup>a</sup>
Cadmium	21.7	6.3	0.80	1.8 (4-day average, acute value) <sup>b</sup>
				0.66 (4-day average, chronic value) <sup>b</sup>
Chromium	122.0	33.8	50.0	0.29 (1-day average) <sup>c</sup> 120 (4-day average) <sup>d</sup>
Lead	41.9	21.6	30.0	1.3 (4-day average) <sup>b</sup>
Mercury	0.68	0.3	0.20	0.012 (4-day average)

<sup>a</sup>U.S. Environmental Protection Agency. Ambient Water Quality Criteria. 1984.

<sup>b</sup>Measured in 1 of 4 samples.

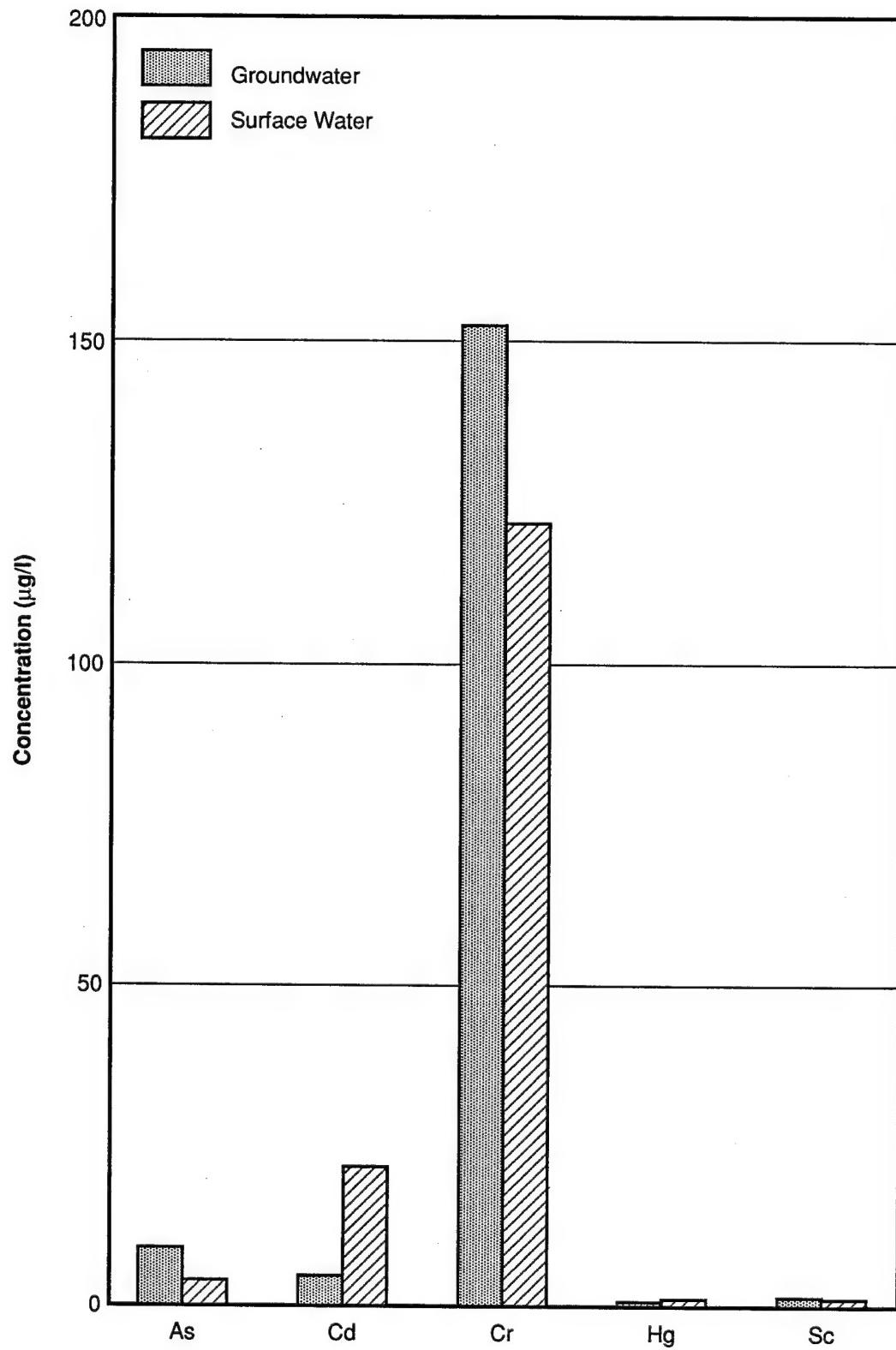
<sup>c</sup>Hexavalent chromium.

<sup>d</sup>Trivalent chromium, hardness of 50  $\mu\text{g/l}$ . Onsite chromium is expected to be in the reduced form.



**FIGURE 6-1.**  
Comparison of Selected Maximum Contaminant Concentrations<sup>®</sup>  
for Soil and Sediments, 125th Fighter Interceptor Group,  
Florida Air National Guard, Jacksonville, Florida.





**FIGURE 6-2.**  
Comparison of Selected Maximum Contaminant Concentrations  
for Groundwater and Surface Water, 125th Fighter Interceptor  
Group, Florida Air National Guard, Jacksonville, Florida.





- A. FANG property is urbanized, including buildings, paved areas (roads and runways), and mowed grass cover.



- B. Access is restricted. FANG is bordered by wetlands and forested area.

**FIGURE 6-3.** ©  
Physical Features, 125th Fighter Interceptor Group, Florida Air  
National Guard, Jacksonville, Florida.



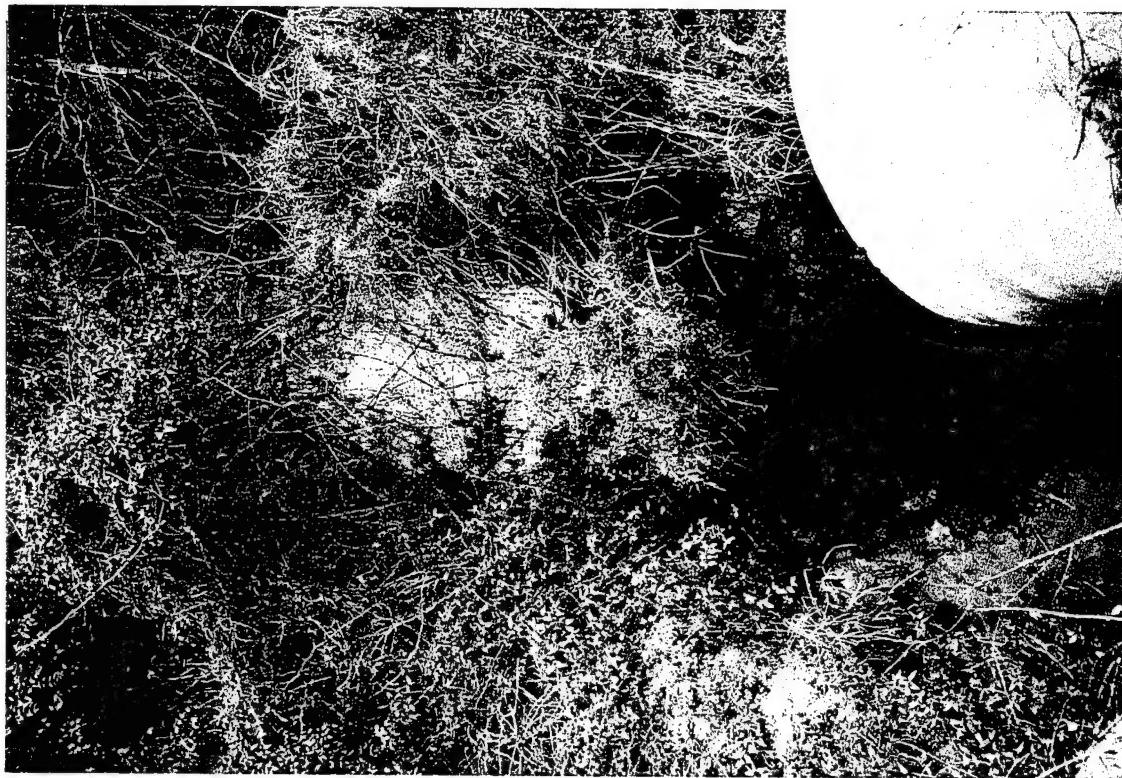


- C. The drainageway collects runoff from Jacksonville International Airport, located northeast of FANG.



- D. The drainageway is inundated with cattails along the entire length, with occurrences of sawgrass, water pennywort, buttonbush, rushes, and mats of filamentous algae.

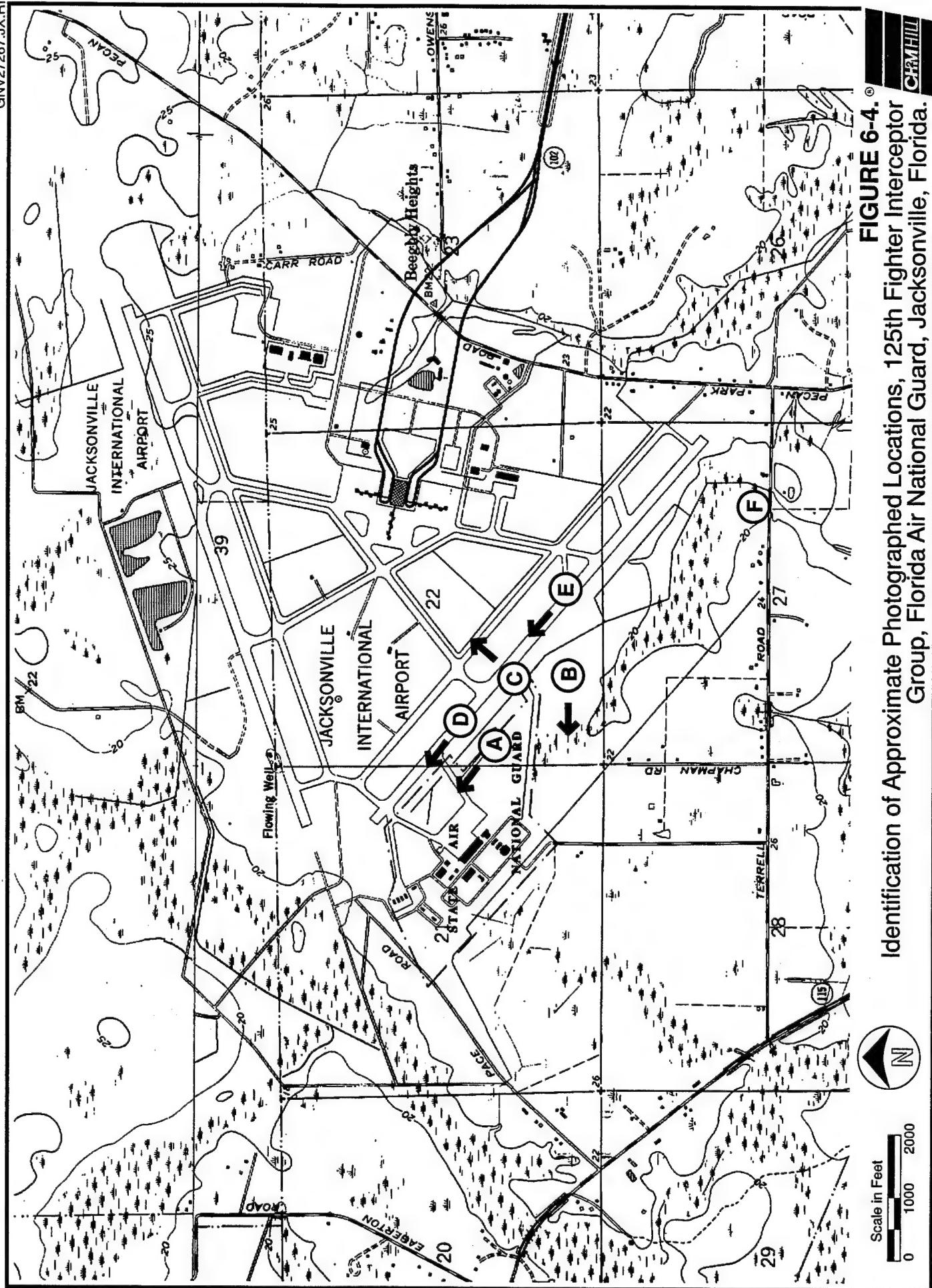
FIGURE 6-3 (Cont.).



- E. The drainageway varies from 5 to 20 feet in width and from 2 inches to at least 3 feet in depth in downstream pools. This is downstream of the drainage from the airport.

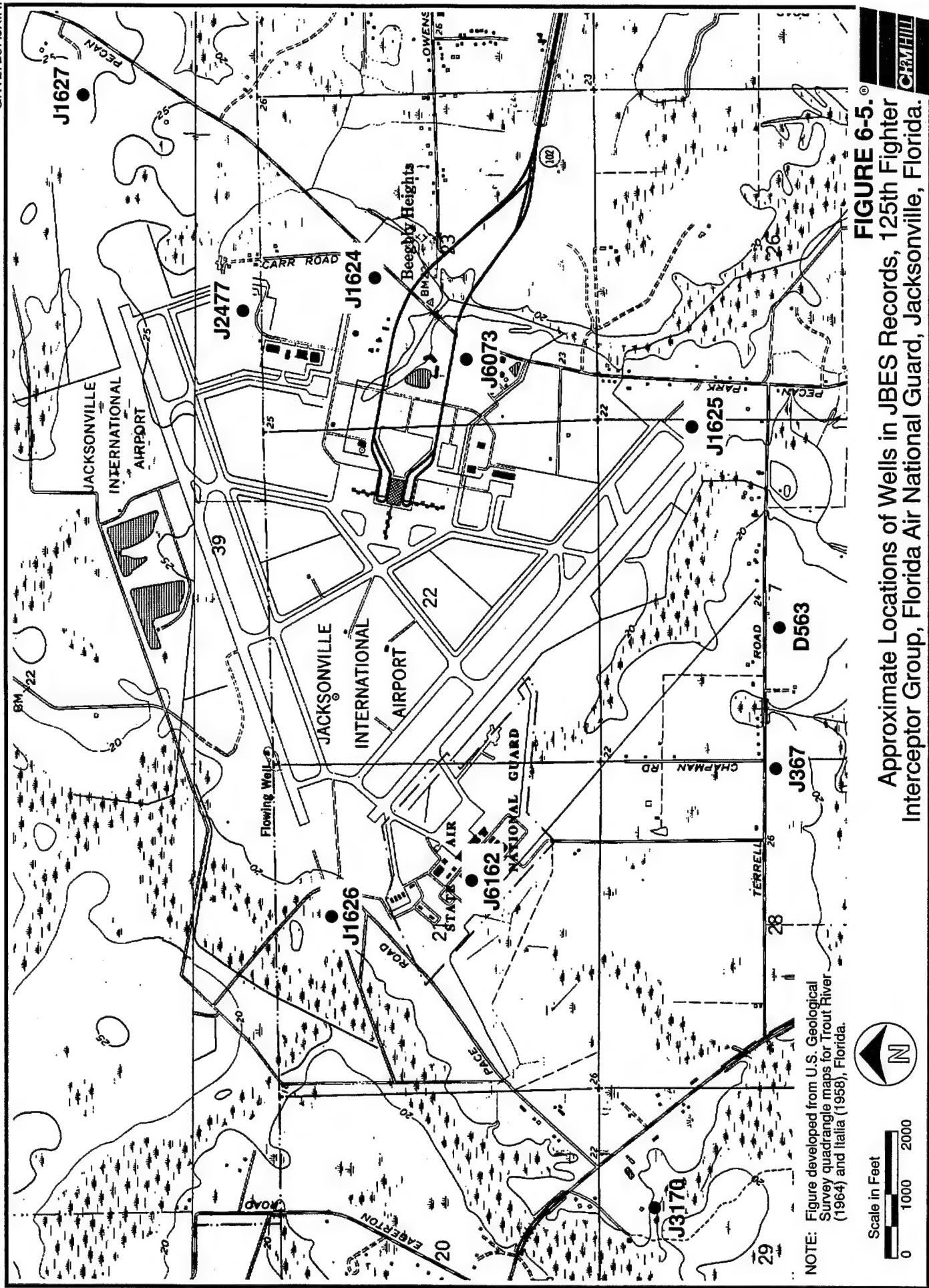
- F. The drainageway discharges to Cedar Creek. Access is possible adjacent to Terrell Road. Extensive recreational use is not anticipated, as the property is owned by the airport.

**FIGURE 6-3 (Cont.).**



**FIGURE 6-4.** Identification of Approximate Photographed Locations, 125th Fighter Interceptor Group, Florida Air National Guard, Jacksonville, Florida.





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**SECTION 7**  
*Conclusions*

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## **7. CONCLUSIONS**

### **7.1 HYDROGEOLOGY**

The shallow groundwater flow at FANG is variable and closely associated with surface drainage patterns. The surficial aquifer materials at the sites to the east (Sites 1, 2, 3E, 3W, 4, 7, and 8) are very fine grained; hydraulic conductivity is about 1 ft/day and groundwater velocity is about 0.0025 to 0.125 ft/day (based on a range of porosity from 0.2 to 0.4). At Sites 5 and 6 on the western side of FANG, the surficial aquifer materials are coarser grained, hydraulic conductivity is on the order of 5 ft/day, and groundwater velocity is about 0.0125 to 1.25 ft/day (based on a range of porosity of 0.2 to 0.4). The hydraulic gradients observed at the sites under both dry and wet conditions were very shallow, on the order of 0.001 to 0.05 ft/ft.

Groundwater flow velocities appear to be slow in the shallow aquifer, with the estimated average velocity ranging from 0.0025 to 0.05 ft/day, so horizontal contaminant transport is also expected to be slow. Contaminant movement is probably mitigated by adsorption of contaminants onto organic matter in the soils. The upward vertical gradient between the shallow unconfined aquifer and deeper confined aquifers is expected to inhibit downward migration of contaminants.

### **7.2 SOIL CONTAMINATION**

As described in Section 1.5, FDER defines soil contamination as existing when OVA readings exceed 500 ppm. Several OVA readings at the eight sites were above that level during the first step of the SI. However, headspace analyses conducted during the second step of the SI with a carbon filter on the OVA indicated that a significant component of the reported concentration was methane gas, which could be the product of naturally occurring organic matter in the soils or low levels of organic contaminants. As a result, no significant soil contamination is believed to exist at any of the sites.

This conclusion is supported by the results of laboratory analyses, which are not required by applicable regulations but were conducted on selected samples to better define possible contaminants. Laboratory analyses detected volatile organics in only one soil sample; a semivolatile organic was found in four soil samples but was also detected in the laboratory QC blank and is a common laboratory contaminant. Some metals were detected in the soil samples at concentrations above those in the background samples.

Based on assumptions about possible worker exposures to soils, the maximum contaminant concentrations at all of the sites indicate non-carcinogenic risks associated with soils are acceptable. The Hazard Index value does not include lead, because information is not currently available from EPA to use in the calculation. However, lead concentrations in soils at the sites are lower than the interim cleanup level.

### **7.3 GROUNDWATER CONTAMINATION**

Laboratory analyses indicate groundwater contamination is present at several of the sites at FANG. The magnitude and extent of groundwater contamination are less than was anticipated from the information obtained from the records search<sup>1</sup>; spill volumes may have been overestimated or natural contaminant mitigation processes, such as dilution, evaporation, or biodegradation, may have had some effect.

Data from well point samples may not reflect representative contaminant concentrations in the surficial aquifer, because the well points penetrate only the upper 1 to 2 feet of the saturated zone. However, many of the contaminants detected are lighter than water and would tend to concentrate in the upper portion of the saturated zone. Overall, data from monitor well samples are more representative of ambient concentrations in the surficial aquifer, because the wells are completed to a greater depth in the saturated zone.

### **7.3.1 Site 1**

At Site 1, chromium was detected in excess of the Florida drinking water standard in one well point during the first step of the SI and in the two monitor wells installed at the site during the second step. The source of the contamination is unknown, but it may be related to discharges from jet engines or engine cleaning. Chromium concentrations reported for soil samples from Site 1 were below the background concentration. The volatile organics detected in a single well point at Site 1 during the first step of the SI may indicate localized contamination, as volatile organics were not detected in the monitor wells installed during the second step of the SI.

No current completed groundwater exposure pathways were identified. The reasonable maximum exposure to groundwater contaminants is assumed to potentially occur in a potable well installed in the lower aquifer.

The Hazard Index ranking for Site 1 is less than 1 based on assumptions regarding potential worker exposures to maximum estimated concentrations. This does not include a risk calculation for an estimated lead concentration at the site, because an RfD for lead for use in the Hazard Index method is not available.

The excess lifetime cancer risk for exposure to these estimated contaminant concentrations is  $3 \times 10^{-7}$  at Site 1. This risk is considered low and offsite transport is unlikely, which minimizes the potential for exposure.

### **7.3.2 Site 2**

Four well points at Site 2 showed detectable concentrations of volatile organics during the first step of the SI, and lead was detected in excess of the Florida drinking water standard in three well points. During the second step of the SI, lead was analyzed for in field-filtered and unfiltered samples from two additional well points and concentrations were much lower. No volatile organics were detected in excess of standards.

No current completed groundwater exposure pathways were identified. The reasonable maximum exposure to groundwater contaminants is assumed to potentially occur in a potable well installed in the lower aquifer.

The risk associated with lead at the site could not be calculated because of the lack of an RfD from EPA, but the Hazard Index for estimated concentrations of all other constituents is well below 1. The excess lifetime cancer risk was calculated as  $3 \times 10^{-9}$ .

Any contamination from fuel spills at Site 2 appears to be limited to the area beneath the parking apron. Access to contaminated groundwater is restricted by the concrete parking apron and offsite transport is unlikely, which minimizes the potential for exposure.

### **7.3.3 Site 3E**

At Site 3E, volatile organic constituents were detected in excess of Florida drinking water standards and FDER guidance criteria in WP 3E-6 during the first step of the SI and in MW 3E-1 during the second (the two locations are within 5 feet of each other). Several low concentrations of volatile organic constituents were detected in WP 3E-9 during the first step of the SI but none were detected in MW 3E-2, which was constructed during the second step within 5 feet of the well point. The results indicate that localized contamination is present at Site 3E near MW 3E-1, but the zone of contamination appears to be isolated and may be relatively immobile based on the low permeability of site soils.

No current completed groundwater exposure pathways were identified. The reasonable maximum exposure to groundwater contaminants is assumed to potentially occur in a potable well installed in the lower aquifer.

The risk assessment indicates a Hazard Index of less than 1 and an excess lifetime cancer risk of  $2 \times 10^{-7}$ . These are low risk factors, especially considering the restricted site access and minimal potential for offsite transport of contaminants.

#### **7.3.4 Site 3W**

No contaminants were detected in excess of Florida drinking water standards or FDER groundwater guidance criteria at Site 3W.

#### **7.3.5 Site 4**

Several low concentrations of volatile organic constituents were detected during the first step of the SI at Site 4, but only the criteria for ethyl benzene was exceeded (in WP 4-1). The potential for transport and/or exposure to contaminants at this site is low and site access is restricted.

No current completed groundwater exposure pathways were identified. The reasonable maximum exposure to groundwater contaminants is assumed to potentially occur in a potable well installed in the lower aquifer.

The Hazard Index is less than 1 and the excess lifetime cancer risk is  $2 \times 10^{-7}$ , which indicates a low risk potential for potential future groundwater exposures.

#### **7.3.6 Site 5**

At Site 5, volatile organic constituents in excess of Florida drinking water standards were detected in one well point during the first step of the SI, in one monitor well installed during the second step of the SI, and in two monitor wells installed by others as part of an ongoing UST investigation. Semivolatile organics were not detected in site well points, as would be expected for OWSs receiving fluids associated with vehicle maintenance (e.g., motor oil, brake fluid, or transmission fluid). The absence of semivolatile organics and reported contamination of the UST monitor wells indicate that the underground tank is probably the major source of contamination at Site 5.

No current completed groundwater exposure pathways were identified. The reasonable maximum exposure to groundwater contaminants is assumed to potentially occur in a potable well installed in the lower aquifer.

The Hazard Index for potential groundwater exposure is less than 1 and the excess lifetime cancer risk is  $2 \times 10^{-7}$ . Site access is restricted and offsite transport is unlikely, which makes exposure to contaminants unlikely.

### **7.3.7 Site 6**

Chromium in excess of the Florida primary drinking water standard was detected in five well points and one monitor well installed at Site 6. A comparison of filtered and unfiltered sample results indicates that the chromium is associated with suspended sediments in the groundwater samples.

The Hazard Index for potential groundwater exposure is less than 1 and the excess lifetime cancer risk is  $3 \times 10^{-8}$ . These values do not suggest potential risks for this pathway. However, the hydrogeologic assessment indicates groundwater may be flowing toward a wetland area northwest of the site. Slug test results indicate the aquifer material at this site has a higher permeability than at the other sites. Transport of chromium to the wetland could cause environmental risks to aquatic receptors, although data suggest chromium is present in the less toxic and less mobile trivalent form.

### **7.3.8 Site 7**

No contaminants were detected at Site 7 in excess of Florida drinking water standards or FDER groundwater guidance criteria.

### **7.3.9 Site 8**

At Site 8, volatile organics and naphthalenes were detected in well points installed in the first step of the SI. No contaminants were detected in excess of Florida drinking water standards or groundwater guidance criteria in the three monitor wells installed as part of the second step of the SI, and no volatile or semivolatile organics were found above detection limits. The well points were installed closer to the OWS (the probable source of the contamination) than the monitor wells, so groundwater may be contaminated by organic constituents in a localized area adjacent to the OWS. The soil samples collected during monitor well installation

did not indicate soil contamination that could be a continuing source of local groundwater contamination.

No current completed groundwater exposure pathways were identified. The reasonable maximum exposure to groundwater contaminants is assumed to potentially occur in a potable well installed in the lower aquifer.

The Hazard Index for Site 8 is less than 1 and the excess lifetime cancer risk is  $2 \times 10^{-7}$ . The extent of contamination is limited and offsite transport is unlikely.

#### **7.4 DRAINAGEWAY CONTAMINATION**

The only apparent surface connection from a site to the drainageway network is at Site 1, where a surface drainage feature may convey water from the OWS inlet on the west side of Site 1 to Reach 3 (see Attachment 1). Based on the lack of contamination in sediment samples collected at locations between the site and Reach 3, there is no indication that contamination in the drainageways could result from surface water transport from Site 1.

A clear connection was also not established between any of the other sites and the contaminants detected in the surface water and sediment samples taken from the drainageways at FANG. Other potential sources of drainageway contamination include current OWS discharges and runoff from the Jacksonville International Airport.

Cadmium, chromium, lead, and mercury were found in onsite surface waters in excess of Florida standards and could be related to site activities. In the downstream samples collected in the drainageway near the limits of FANG property, only mercury was detected above Florida Class III surface water criteria. Mercury was not detected consistently in upstream water samples or in any sediment samples, and there is no known source of mercury at any of the sites at FANG.

Several volatile and semivolatile organic constituents were detected in sediment samples, as well as arsenic, barium, cadmium, chromium, and lead above

background levels. No consistent trend in the occurrence of contamination was seen.

The preliminary risk assessment concluded that the restricted access to the onsite drainageways will prevent excess risks to human health from contaminants in the surface water and sediments. Mercury may pose an environmental risk to animals that live or feed in the drainageways because of its tendency to bioaccumulate in the food chain. Alligators and wading birds are the most likely receptors of environmental risks as a result of mercury contamination of drainageway surface water downstream of FANG. The chromium detected above surface water criteria in groundwater from Site 6 could cause environmental risks to aquatic receptors if it migrated to a nearby wetland, although it is expected to be in the less toxic trivalent form.

The sources of the contaminants detected in the drainageway surface water and sediments are not clear. Although past activities at the eight sites may have contributed to drainageway contamination, they are probably not the only sources. Potential sources include current practices at FANG (e.g., OWS discharges) and runoff and stormwater discharges from Jacksonville International Airport.

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**SECTION 8**  
*Recommendations*

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## **8. RECOMMENDATIONS**

Recommendations for further action at the eight sites at FANG were developed based on the data gathered during the two steps of the SI, the hydrogeologic assessment, and the preliminary risk assessment. The recommendations are discussed below for each site.

### **8.1 SITE 1**

No further action is recommended at Site 1. Chromium was detected above the Florida drinking water standard, but the shallow aquifer is not currently nor expected to be used for potable water. Site access is restricted, so exposure to contamination is unlikely. Offsite contaminant migration to a water supply well is unlikely, as groundwater from this site probably discharges into drainageway Reach 3. Surface water samples from the drainageway reach showed chromium concentrations well below the Florida drinking water standard. A decision document (DD) recommending no further action will be prepared for this site.

### **8.2 SITE 2**

No further action is recommended at Site 2, as concentrations of volatile organics are low, access is limited (especially beneath the concrete aircraft parking apron), and the potential for migration is low. Floating hydrocarbons were not detected in the well points at the site and volatile organic concentrations are not indicative of a widespread contaminant plume. Past fuel spills, the probable source of the contaminants, are reportedly no longer likely to contribute to groundwater contamination. The groundwater at Site 2 probably moves very slowly and no contact with human or environmental receptors is likely.

The lead concentrations detected in groundwater samples from WP 2-6, 2-9, and 2-10 appear to be a result of the presence of lead in suspended solids. Lead concentrations were low in samples taken from WP 2-12 and 2-13 during the second step of the SI. A DD recommending no further action will be prepared for Site 2.

### **8.3 SITE 3E**

Monitoring only is recommended at Site 3E. Concentrations of 1,1-dichloroethane and benzene detected in the sample from MW 3E-1 exceeded primary drinking water standards. The FDER guidance criteria for ethyl benzene, total xylenes, and total VOAs were also exceeded. However, the volatile organic concentrations detected in MW 3E-1 are not indicative of a widespread contamination problem. The ground-water analyses from surrounding well points and the downgradient monitor well (MW 3E-2) indicate the contamination is limited to a localized area. This is consistent with the soils data gathered at the site, which indicate that the low permeability and the heterogeneity of the soils inhibit movement of shallow groundwater. A DD recommending continued groundwater monitoring of MW 3E-1 will be prepared for this site.

### **8.4 SITE 3W**

No further action is recommended at Site 3W. No organic contaminants were detected in groundwater samples, and lead concentrations were well below Florida standards. A DD recommending no further action will be prepared for this site.

### **8.5 SITE 4**

Several volatile and semivolatile organic constituents were detected in groundwater samples at Site 4, but the only applicable criteria exceeded was for ethyl benzene in WP 4-1. Because concentrations and the potential for exposure and transport are low, a DD recommending no further action will be prepared for this site.

### **8.6 SITE 5**

At Site 5, no further action is recommended related to the OWS and a DD should be prepared. Data gathered from the three well points, the two monitor wells, and the three monitor wells previously installed by others indicate that the major source of the reported groundwater contamination is probably leaking piping associated with the UST. Well point samples did not report semivolatile organics, as would be expected for OWSs receiving fluids associated with vehicle maintenance (e.g., motor oil, brake

fluid, or transmission fluid). The absence of semivolatile organics and the reported contamination of the UST monitor wells indicate the UST system is probably the major source of contamination at Site 5. Further investigation of the UST source is being pursued by FANG.

### **8.7 SITE 6**

Chromium in exceedance of the drinking water standard was detected at Site 6 in unfiltered groundwater samples from five well points and one monitor well. No chromium was detected in filtered samples from two monitor wells and three well points. The chromium detected in groundwater samples appears to be related to the suspended sediments in the samples.

Because the potential source of contamination at Site 6 appears to have been removed and the chromium associated with soils is probably not mobile under current conditions of the shallow aquifer, no further action is recommended at Site 6. A DD recommending no further action will be prepared for this site.

### **8.8 SITE 7**

No further action is recommended at Site 7. No volatile or semivolatile organic constituents were detected in any of the groundwater samples from the seven well points installed at the site. Lead was detected in the groundwater at concentrations well below the Florida standard. Chromium was detected in an unfiltered groundwater sample at a concentration less than the Florida standard. A DD recommending no further action will be prepared for this site.

### **8.9 SITE 8**

No further action is recommended at Site 8. The volatile organics and naphthalenes detected in the well points in the first step of the SI may be indicative of a localized contamination event, possibly OWS spills or leaching from the unlined pit used as an OWS prior to 1981. No volatile or semivolatile organics were detected in the soil or groundwater samples collected from the three monitor wells installed during the second step of the SI at a slightly farther distance from the OWS. The Hazard Index

for potential future exposures to groundwater for Site 8 is less than 1 and the calculated excess lifetime cancer risk is  $2 \times 10^{-7}$ . A DD recommending no further action will be prepared for this site.

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## **REFERENCES**

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## REFERENCES

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**APPENDIX A**  
*NGB/FDER Correspondence*

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## Florida Department of Environmental Regulation

Twin Towers Office Bldg. • 2600 Blair Stone Road • Tallahassee, Florida 32399-2400

Bob Martinez, Governor

Dale Twachtman, Secretary

John Shearer, Assistant Secretary

October 27, 1989

Captain Lewis Harden  
Florida Air National Guard  
Headquarters, 125th Fighter  
Interceptor Group  
P.O. Box 18018  
Jacksonville, FL 32229-0018

Dear Captain Harden:

Department personnel have completed the technical review of the Site Investigation for 125th Fighter Interceptor Group, Florida Air National Guard, Site Investigation Technical Memorandum, September 1989. Our recommendations are that:

1. Additional sampling and analyses of groundwater at Site 2 for lead and BETX be performed. Filtered and unfiltered samples should be done for lead.
2. Groundwater at well points locations 3W-5, 7-2 and 7-5 be sampled and analyzed since the well points were flooded before samples could be obtained.

If you have any questions about this matter, please contact me at 904/488-0190.

Sincerely,

Eric S. Nuzie  
Environmental Supervisor II  
Bureau of Waste Cleanup

ESN/mlr

cc: Satish Kastury  
Ashwin Patel/Indar Jagnarine



DEPARTMENTS OF THE ARMY AND THE AIR FORCE

NATIONAL GUARD BUREAU  
WASHINGTON, D. C. 20310-2500



30 NOV 1989

RECEIVED  
CH2M HILL  
DEC 5 1989

MAIL ROOM-GNW

Eric S. Nuzie, Environmental Supervisor II  
Bureau of Waste Cleanup  
Florida Department of Environmental Regulation  
Twin Towers Office Building  
2600 Blain Stone Road  
Tallahassee, Florida 32399-2400

Dear Mr. Nuzie

This is in response to your October 27th comments on the Site Investigation (SI) Technical Memorandum (TM) report for the 125th Fighter Interceptor Group, Florida Air National Guard, Jacksonville, Florida. The field sampling activities have been revised as follows:

1. Two wellpoints will be installed at the edge of the parking apron at Site 2. One sample for volatile organics analysis (EPA Method 601/602) will be collected from each wellpoint. One filtered and one unfiltered lead sample will also be collected from each wellpoint. The samples for lead analysis will be filtered in the field using an in-line filter on a peristaltic pump, as specified by the FDER QA staff.
2. New wellpoints will be installed at the same approximate locations as the previously installed 3W-5, 7-2, and 7-5 wellpoints. Parameters to be sampled are lead (unfiltered) and EPA Methods 601/602 & 610.

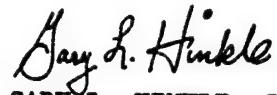
In response to a telecon discussion between Mr. Williams of my staff, Mr. Crane, and yourself on November 22nd, the surficial aquifer will also be sampled to determine the general water quality to demonstrate its potability. Samples collected from monitor wells 1-2 and 3E-1 will be analyzed for total dissolved solids, iron, and hardness in addition to those parameters planned in the SI TM.

The field activities outlined in the SI TM, as modified above, began on November 27th and are scheduled to be completed by December 8th. The results of this field effort as well as the results from screening activities presented in the SI TM will be summarized in the SI Report. This report should be available for your review in the Spring of 1990.

This letter should be attached to and become part of the SI TM.

Please address any questions or comments to Mr. Don Williams of my staff, (301) 981-8159.

Sincerely



GARY L. HINKLE, Chief  
Installation Restoration Program Br  
Environmental Division

cc: Rebecca L. Svatos/CH2M HILL  
Carl Wheeler/HAZWRAP  
CPT Lewis Harden/FANG



Engineers  
Planners  
Economists  
Scientists

September 5, 1990

GNV27267.JX

Mr. Ashwin Patel  
Northeast District  
Florida Department of  
Environmental Regulation  
3426 Bills Road  
Jacksonville, FL 32207

Dear Ashwin:

Subject: Draft Site Investigation Report, Florida Air National Guard

Enclosed for your review is one copy of the Draft Site Investigation Report for the Florida Air National Guard in Jacksonville. Two copies of the report have also been sent to Eric Nuzie in Tallahassee for his review.

Please send your written comments to Don Williams of the National Guard Support Center within 4 weeks. Mr. Williams will be sending you a letter to request a date for a review meeting to discuss your comments.

Please call me if you have any questions.

Sincerely,

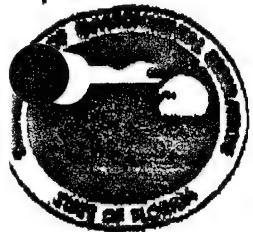
CH2M HILL

A handwritten signature in cursive ink that reads "Rebecca L. Svatos".

Rebecca L. Svatos, P.E.  
Project Manager

GNVCR27/085.51

xc: Eric Nuzie/FDER/Tallahassee (2 copies)  
Capt. William Norton/FANG (2 copies)  
Don Williams/NGB (7 copies)  
Steve Fleming/Energy Systems (5 copies)



*Florida Department of Environmental Regulation*

**Twin Towers Office Bldg. • 2600 Blair Stone Road • Tallahassee, Florida 32399-2400**

Dale Tschirhart, Secretary

John Shearer, *Auditions Rehearsal*

October 18, 1990

Captain William Norton  
Florida Air National Guard  
Headquarters, 128th Fighter  
Intercepto~~r~~ Group  
P. O. Box 18018  
Jacksonville, Florida 32229-0018

Dear Captain Norton:

Department personnel have completed the technical review of the Draft Site Investigation Report for 123rd Fighter Interceptor Group, Florida Air National Guard, September 1990. The attached memorandum from Dr. James J. Crane to me documents the Department's concerns. Please note that the comments under Other Comment are based upon available information that the oil/water separators discharge to the environment. Unless this premise is incorrect, this situation should be corrected to prevent further contamination from these sources.

If I can be of any further assistance with this matter, please contact me at (904) 488-0190.

Sincerely,  
*Sid Thorpe*  
Eric S. Munie  
Federal Facilities Coordinator

388/3b

Inquiries

991 Ashwin Patel



State of Florida  
DEPARTMENT OF ENVIRONMENTAL REGULATION

For Recalling To Completing The Address	
1.	Line 1
2.	Line 2
3.	Line 3
4.	Line 4

# Interoffice Memorandum

TO: Eric Munie, Federal Facilities Coordinator, Bureau  
of Waste Cleanup

FROM: Dr. James J. Crane, Environmental Administrator,  
Technical Review Section, Bureau of Waste Cleanup *JJL*

DATE: October 5, 1990

SUBJECT: Draft Site Investigation Report for 128th Fighter  
-----  
National Guard

I've reviewed the subject document and provide these comments for your consideration. The comments are provided on a site-by-site basis.

### Site 1. Oil/Water Separator Inlets Along Aircraft Parking Apron

The assessment and conclusions are satisfactory. The recommendation for no further action appears to be supported by the data, risk assessment and risk management presentations.

### Site 2. Subsurface of Aircraft Parking Apron

The assessment and conclusions are satisfactory. The recommendation for no further action appears to be supported by the data, risk assessment and risk management presentations.

### Site 3E. Fire Training Area, East

The assessment and conclusions are generally satisfactory, with one exception. Acetone was reported at 2500 ug/l in WP 3E-6. Since EPA Method 624 was run only on the one well, it is not known whether the acetone is restricted to that one well or whether it may be found elsewhere on the site at even higher values. It may even be a laboratory contaminant, but most blanks were not analyzed by EPA Method 624. This issue should be addressed by resampling WP 3E-6. If the acetone is confirmed, the other wells and surface water should be sampled and analyzed for acetone. These results would then have to be evaluated through the risk assessment process to determine if no further action was an acceptable recommendation at that time.

Site 3W, Fire Training Area, West

The assessment and conclusions are satisfactory. The recommendation for no further action appears to be supported by the data which showed no contamination problem.

Site 4, Oil/Water Separator at Wash House

The assessment and conclusions are satisfactory. The recommendation for no further action appears to be supported by the data, risk assessment and risk management presentations. The oil/water separator (40WS) outfall does appear to be releasing some contaminants as evidenced by the xylene and silver in the water and the xylene in the outfall sediments. This situation should be monitored, and if necessary corrected, before it creates an enforcement problem.

Site 5, Oil/Water Separator at Vehicle Maintenance Building

The assessment and conclusions are satisfactory. The recommendation for the site is appropriate. The UST problem should be investigated and remedied following FDNR rules, Chapter 17-761, F.A.C. and Chapter 17-770, F.A.C.

Site 6, Area outside Munitions building

The assessment and conclusions are satisfactory. The recommendation for no further action except for continued ground water monitoring appears to be appropriate and supported by the data, risk assessment and risk management presentations.

Site 7, Trim Pad for Aircraft Run-Up

The assessment and conclusions are satisfactory. The recommendation for no further action may be supported by the data, risk assessment and risk management presentations. There is one issue to address, though. The surface water at RSC shows a chromium violation of 63.4 ug/l. It appears that site 7 was only sampled for lead. On page 7-3 of the report, it states that chromium may be the result of discharges from jet engines or engine cleaning. Could Site 7 be responsible for the violation in Reach 2 downgradient of the site? Perhaps sampling of WP7-1 and WP7-7 would be prudent to address the issue.

Site 8, Area surrounding Oil/Water Separator at Washroom

The well points at Site 8 showed significant levels of volatile organics and naphthalenes in the ground water, particularly in WPS-3. The monitoring wells showed no similar contamination; however, the surface water and sediments directly downgradient and

downslope show significant levels of volatile organics, naphthalenes, phenol and metals. The monitoring wells are not directly downgradient of the oil/water separator, except for MWB-3 which across the drainageway reach. The discharges from the oil/water separator are apparently moving to the drainageway either through the ground water or by runoff or both.

If the values observed at Site 8 were the result of a past disposal for which the source was terminated, the recommendation for no further action might be supportable. Since the site appears to have a continuing source, some additional work is necessary. A monitoring well directly downgradient of the oil/water separator should be installed and analyzed for volatiles, metals and semivolatiles.

Risk Assessment Comment  
a minimum for adults and a water ingestion rate of 2 liters/day. For the risks defined in the subject document an increase of the soil ingestion rate from 10 mg/day to 100 mg/day still leaves acceptable risk levels for these sites.

Please explain the dilution rate of 1:280 used for the drinking water risk analysis. How was this number arrived at? Please provide calculations and assumptions used.

Other Comment

The oil/water separator (OWS) discharges to the environment should be eliminated to avoid any future contamination or any continuous source of contamination. ICP sites are generally past disposal sites with problems stemming from practices which now would not be allowed or where people know better these days. These sites should not still be discharging to the environment. Measures should be instituted to prevent these discharges.



# DEPARTMENTS OF THE ARMY AND THE AIR FORCE

NATIONAL GUARD BUREAU  
ANDREWS AIR FORCE BASE DC 20331-5008

FEB 7 1991

RECEIVED  
FEB 15 11 00 AM '91

HAZWRAP

Mr Eric Nuzie, Federal Facilities Coordinator  
Bureau of Waste Cleanup  
Florida Department of Environmental Regulation  
2600 Blair Stone Road, Twin Towers Office Bldg  
Tallahassee, Florida 32399-2400

Dear Mr Nuzie

We have received your written comments on the Draft Site Investigation Report for the 125th Fighter Interceptor Group, Florida Air National Guard, Jacksonville, Florida. In general, your comments appear to support our recommendations for no further action at all sites.

Your concern about the oil/water separator discharges to surface ditches or swales has been discussed with Capt. Norton, Base Civil Engineer, 125th FIG. We have requested him to submit project requirement documentation via A106 process to connect the oil/water separators to the sanitary system (POTW) to correct the Clean Water Act violation.

Your comment on the dilution rate used for the drinking water risk analysis has been explained in attachment 1.

The report recommended continued groundwater monitoring for chromium at Site 6, however subsequent resampling at three additional well points confirmed that chromium levels present are within acceptable limits when compared to background values. Based upon this finding, we recommend no further action at this site.

We plan on conducting a meeting on March 25, 1991, to discuss your comments and to determine what actions are required to finalize the SI Report. You are invited to attend this meeting. It is the policy of this office to involve state and local regulatory agencies and to encourage their active participation throughout the IRP process.

Please call Mr Russ Dyer, Project Manager at (301) 981-8149 for the time and place of the meeting and to confirm your attendance.

Sincerely

GARY L. HINKLE, Chief  
Installation Restoration Prog Br  
Environmental Division

1 Atch: Calculation of Dilution Factor

cc: Mr Steve Fleming/HAZWRAP  
Capt Bill Norton/125FIG/DE

COPY



Engineers  
Planners  
Economists  
Scientists

July 29, 1991

GNV27267.JX.RI

Eric Nuzie  
Florida Department of Environmental Regulation  
2600 Blair Stone Road  
Tallahassee, FL 32399-2400

Dear Eric:

The results of the April 10 sampling at Sites 3E and 7 at the Florida Air National Guard facility in Jacksonville are enclosed along with a technical memorandum summarizing the results of the data validation.

You had requested that a wellpoint be installed and sampled for chromium to evaluate whether groundwater at Site 7 was contributing to the chromium detected in the drainageway near this site. Chromium was not detected in the filtered sample collected from WP 7-8 at Site 7, but was detected at a concentration of 0.042 mg/l in the unfiltered sample. This indicates the chromium is probably related to suspended sediments in the water and is not dissolved chromium which would be likely to migrate to the surface drainageway.

The attached table summarizes the volatile organics data collected from MW 3E-1 and WP 3E-6, which was installed in the same area as MW 3E-1 during the first step of the SI. Monitor well 3E-1 was resampled at your request to evaluate the presence of acetone in the groundwater at the site, as previously detected in WP 3E-6.

Acetone was detected at a concentration of 240 ug/l in the sample collected from MW 3E-1 on April 10, 1991. Acetone was previously detected at that approximate location in WP 3E-6 at a concentration of 2500 ug/l. Benzene, toluene, ethyl benzene, xylene, and 1,1-dichloroethane were also detected in this sample at concentrations similar to those previously detected in MW 3E-1 when it was sampled on December 4, 1989. Cis/trans-1,2-dichloroethene was detected in the sample collected from MW 3E-1 on April 10 and had not previously been detected in MW 3E-1. The detected concentration was similar to that detected in the sample collected from WP 3E-6 on June 15, 1989.

The results from the additional sample collected from MW 3E-1 are similar to those obtained during the second step of the SI except acetone was detected. Acetone was previously detected in WP 3E-6 at a much higher concentration. The organic contaminants detected in this well seem to be present in only an isolated area. No volatile organics were detected in MW 3E-2, downgradient of MW 3E-1, when it was sampled in December 1989 during the second step of the SI. No volatile organics were detected in samples from temporary wellpoints installed on either side of the current location of MW 3E-1 during the second step of the SI in June 1989. Slug testing of MW 3E-1 indicated the groundwater flow in the area is on the order of 1 foot/year so any contaminants present are not likely to migrate very quickly.

Erick Nuzie  
Page 2  
July 29, 1991  
GNV27267.JX.RI

The additional data enclosed do not change our previous recommendations of no further action at these sites. The chromium detected in the surface drainageway near Site 7 does not appear to be coming from the groundwater near the trim pad. The volatile organics detected in the sample from MW 3E-1 appear to be present in an isolated area and are not likely to migrate quickly. The acetone detected in MW 3E-1 was an order of magnitude less than previously detected and is not at a level likely to be of concern.

Please call me or Russ Dyer by August 16 to discuss finalizing the SI Report based on the enclosed data and the additional data from Site 6 which was previously submitted to you.

Sincerely,

CH2M HILL



Rebecca L. Svatos, P.E.  
Project Manager

1001144E.GNV

xc: Ashwin Patel/FDER/Jacksonville  
Jim Crane/FDER/Tallahassee  
John Burrell/Energy Systems  
Russ Dyer/NGB  
Capt. Youmans/FANG  
Bill McElroy/CH2M HILL  
Tom Richardson/CH2M HILL

**Site 3E**  
**Volatile Organic Analysis Data**

Sample Date	6/15/89	Duplicate		
		WP 3E-6	MW 3E-1	MW 3E-1
1,1-Dichloroethane	13J	3.7	4.1	6.3
cis/trans-1,2-Dichloroethene	24MJ	<1	<1	10
Benzene	35	31	36	13
Toluene	13	8.1	8.7	2J
Chlorobenzene	2	<1	<1	<5
Ethyl Benzene	2J	26	32	11
Total Xylenes	17	110	130	75
Methylene Chloride	8	NR	NR	<5
Acetone	2500J	NR	NR	240
2-Hexanone	9J	NR	NR	<10
4-Methyl-2-Pentanone	73	NR	NR	<10

Notes:

M = Total 1,2-Dichloroethene

J = Estimated. Analyte was present but the reported value may not be accurate or precise

**M E M O R A N D U M**

**CH2MHILL**

TO: Becky Svastos/GNV  
FROM: Ann Castleberry/MGM  
DATE: June 26, 1991  
SUBJECT: Florida Air National Guard Data Review  
PROJECT #: GNV 27267.JX.RI

**1. INTRODUCTION**

You asked me to review data from a recent sampling event at Florida Air National Guard. Only water samples were submitted to the laboratory, 3 for volatile organic compound analysis (EPA Method 624) and 3 for chromium (EPA CLP Method). The laboratory provided HAZWRAP Level C data packages for all the analyses and the results were reviewed and validated using the HAZWRAP Guidance (HWP-65). The results of the data review and validation process are summarized below.

**2. VOLATILE ORGANIC COMPOUNDS**

Per HAZWRAP Guidance, Level C data packages consist of the CLP summary forms and do not include any raw data; therefore, it is impossible to trace back through the analytical process and reprocess any of the calculations. Forms included for review included:

- Form I--Data Summary
- Form II--Surrogate Spike Recovery
- Form III--MS/MSD Recovery
- Form IV--Method Blank Summary
- Form V--GC/MS Tuning and Mass Calibration for BFB
- Form VI--Initial Calibration
- Form VII--Continuing Calibration Check
- Form VIII--Internal Standard Area Summary

The first note in the cover letter indicated that the continuing calibration relative response factor for Vinyl chloride was above the acceptance range. The relative response factors for bromomethane and Chloroethane were also above the acceptance limit of 25.0 percent. However, none of these compounds were detected in the samples and this does not affect the usability of the data.

100113A5.GNV

### **3. CHROMIUM**

Forms included in the data package for review were:

- Form I--Data Summary Report
- Form II--Initial and Continuing Calibration Verification
- Form III--Blanks
- Form IV-MS Spike Sample Recovery
- Form VI--Duplicates
- Form VII--Laboratory Control Sample Results
- Control Chart data

The information in the cover letter indicated that the data was within the CLP acceptance limits. A review of the data package verified this.

### **4. SUMMARY AND CONCLUSIONS**

The data is acceptable for use without any further qualifications.



# Florida Department of Environmental Regulation

Twin Towers Office Bldg. • 2600 Blair Stone Road • Tallahassee, Florida 32399-2400  
Lawton Chiles, Governor

Carol M. Browner, Secretary

August 16, 1991

Mr. Bill McElroy  
CH<sub>2</sub>M Hill  
Gainesville Office  
7201 N.W. 11th Place  
P.O. Box 1647  
Gainesville, FL

Dear Mr. McElroy:

As agreed upon during our March 25, 1991 meeting at the Florida Air National Guard, this letter is to notify you that Department personnel have completed the technical review of information related to Site 6. Based upon site conditions and other pertinent data, specifically the groundwater use in the area and results of the filtered and unfiltered chromium samples, we concur with the recommendation of no further action. If site conditions change or additional information is obtained in the future that indicate that a contamination problem exists, Department personnel will further evaluate the situation and provide technical assistance.

If I can be of any further assistance with this matter, please contact me at (904) 488-0190.

Sincerely,

Eric S. Nuzie  
Federal Facilities Coordinator

ESN/dd

cc: Brian Cheary



## Florida Department of Environmental Regulation

Twin Towers Office Bldg. • 2600 Blair Stone Road • Tallahassee, Florida 32399-2400

Lawton Chiles, Governor

Carol M. Browner, Secretary

October 1, 1991

Ms. Rebecca L. Svatos, P.E.  
CH<sub>2</sub>M Hill  
P.O. Box 1647  
Gainesville, FL 32602-1647

RECEIVED  
CH2M HILL

OCT 7

MAIL ROOM-ONLY

Dear Ms. Svatos:

Department personnel have completed the evaluation of the additional data for Sites 7 and 3E at Florida Air National Guard, 125th Fighter Interceptor Group. I have enclosed a memorandum from Dr. James J. Crane to me. It documents our comments on this matter.

If I can be of any further assistance, please contact me at (904) 488-0190.

Sincerely,

Eric S. Nuzie  
Federal Facilities Coordinator

ESN/dd

Enclosure

cc: Brian Cheary  
Mickey Hartnett  
Jerry Young  
Russ Dyer

enltr2.doc



State of Florida  
DEPARTMENT OF ENVIRONMENTAL REGULATION

For Routing To Other Than The Addressee			
To:	Location:	To:	Location:
To:	Location:	To:	Location:
From:	Date:		

# Interoffice Memorandum

**TO:** Eric Nuzie, Federal Facilities Coordinator, Bureau of Waste Cleanup

**FROM:** *JJC* Dr. James J. Crane, Professional Geologist/Technical Review Section Administrator, Bureau of Waste Cleanup

**DATE:** September 9, 1991

**SUBJECT:** July 29, 1991 Letter from Rebecca L. Svatos to Eric Nuzie, Florida Air National Guard, 125th Fighter Interceptor Group - Review

I've reviewed the subject letter and the attached data for Sites 7 and 3E. These comments are submitted in response to the letter's conclusions and recommendations.

Apparently a wellpoint, WP7-8 was installed and sampled at Site 7; unfortunately the location of the well point was not provided. It may be that we may be able to approve the no further action recommendation, but not until the location of the sampling point is known.

Also, well MW-3E-1 was sampled and analyzed for acetone and other volatile organics. It appears that the acetone is below the guidance concentration of 700 ppb, thus it does not violate the minimum criteria. The total Benzene (BETX), Toluene, Ethylbenzene and Xylenes was significantly above 50 ppb, i.e., 101 ppb. We consider this level too elevated to agree to no further action. This well should be sampled and analyzed every six months for BETX. If the levels decrease below 50 ppb, a no further action approval would be obtainable. Since it has been almost six months since the last analysis, it may be possible that a current round of sampling and analysis may result in the desired results.

/sr



DEPARTMENT OF THE AIR FORCE  
AIR NATIONAL GUARD READINESS CENTER  
ANDREWS AIR FORCE BASE, DC 20331-6008

APR 13 1992

Mr. Eric S. Nuzie  
Federal Facilities Coordinator  
Florida Department of Environmental Regulation  
2600 Blair Stone Rd.  
Tallahassee, Florida 32399-2400

Dear Mr. Nuzie

In response to your letter of October 1, 1991 regarding additional information collected at sites 3E and 7, MW-3E-1 was resampled on October 30, 1991. The laboratory data package and the data validation memorandum for the sample, the bailer blank and the trip blank are attached. Also attached is a table summarizing the contaminant concentrations detected in this well in October as well as the historical data.

You requested that MW-3E-1 be resampled because the total Benzene, Toluene, ethylbenzene and xylene (BTEX) concentration in the well was 101 ug/l when it was sampled on April 10, 1991. The BTEX concentration last October was 87 ug/l, less than the concentration in the April sample, but still greater than the FDER guidance concentration of 50 ug/l. The BTEX concentrations have declined from 175 ug/l in December, 1989 (207 ug/l in the duplicate sample) to the current level of 87 ug/l. Because the preliminary risk assessment did not indicate unacceptable risk levels associated with the higher 1989 BTEX concentrations and considering concentration levels are declining, we request concurrence from FDER that no further action is required at site 3E.

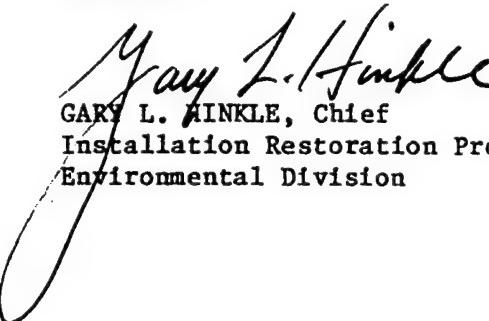
We had failed to provide the location of WP-7-8 when we provided the data on the sample collected from that wellpoint. The wellpoint was installed approximately two feet northwest of where WP-7-7 was located as shown on the attached map. Based on this information we request your concurrence with our recommendation for no further action at site 7.

In your letter dated October 18, 1990, you stated that the recommendations for no further action at sites 1,2,3W,4 and 5 were appropriate. At the March 25, 1991, review meeting for the Draft Site Investigation report, we discussed the data on site 8 and you concurred that no further action was necessary at that site. After reviewing additional data we provided you on site 6, you stated in your letter dated August 16, 1991, that you concurred with our recommendation for no further action at that site.

Following your review of the data attached to this letter, we request your written concurrence that no further action is necessary at any of the eight sites previously discussed under IRP investigation. We anticipate preparing decision documents recommending no further action at the eight IRP sites pending your response.

If you have any questions, please contact Mr. Russell Dyer at ANGRC/CEVR,  
Building 3500, Andrews AFB, Md 20331-6008, (301) 981-8149.

Sincerely

  
GARY L. HINKLE, Chief  
Installation Restoration Program Br  
Environmental Division

4 Atchs

1. Site Maps (3E,7)
2. MW-3E-1 Table
3. Lab Data Package
4. Data Validation Memo

cc: TAG Florida  
125th FIG/CC  
125th FIG/DE

**Florida Air National Guard**  
**Monitor Well MW-3E-1 Volatile Organic Data**  
**(Concentrations in  $\mu\text{g/l}$ )**

Volatile Organic Detected	Date Sampled			
	12/4/89	12/4/89 (Duplicate)	4/10/91	10/30/91
1,1-Dichloroethane	3.7	4.1	6.3	14
cis/trans-1,2-Dichloroethene	<1	<1	10	17
Benzene	31	36	13	17
Toluene	8.1	8.7	2J	2J
Ethyl Benzene	26	32	11	17
Total Xylenes	110	130	75	51
Methylene Chloride	NR	NR	<5	5
Acetone	NR	NR	240	11B
4-Methyl-2-Pentanone	NR	NR	<10	2J
Total BTEX	175	207	101	87

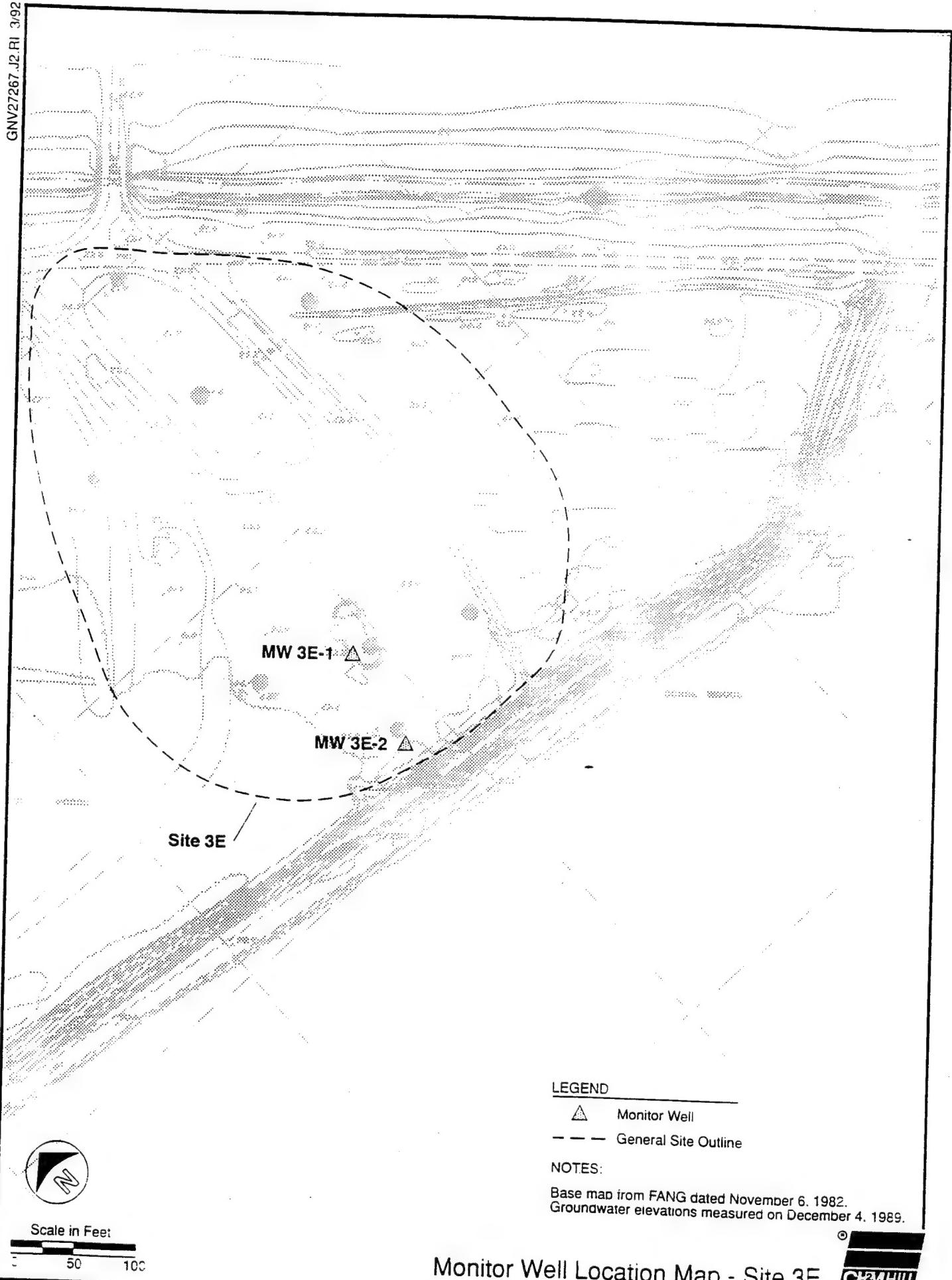
Notes:

M = Total 1,2-Dichloroethene

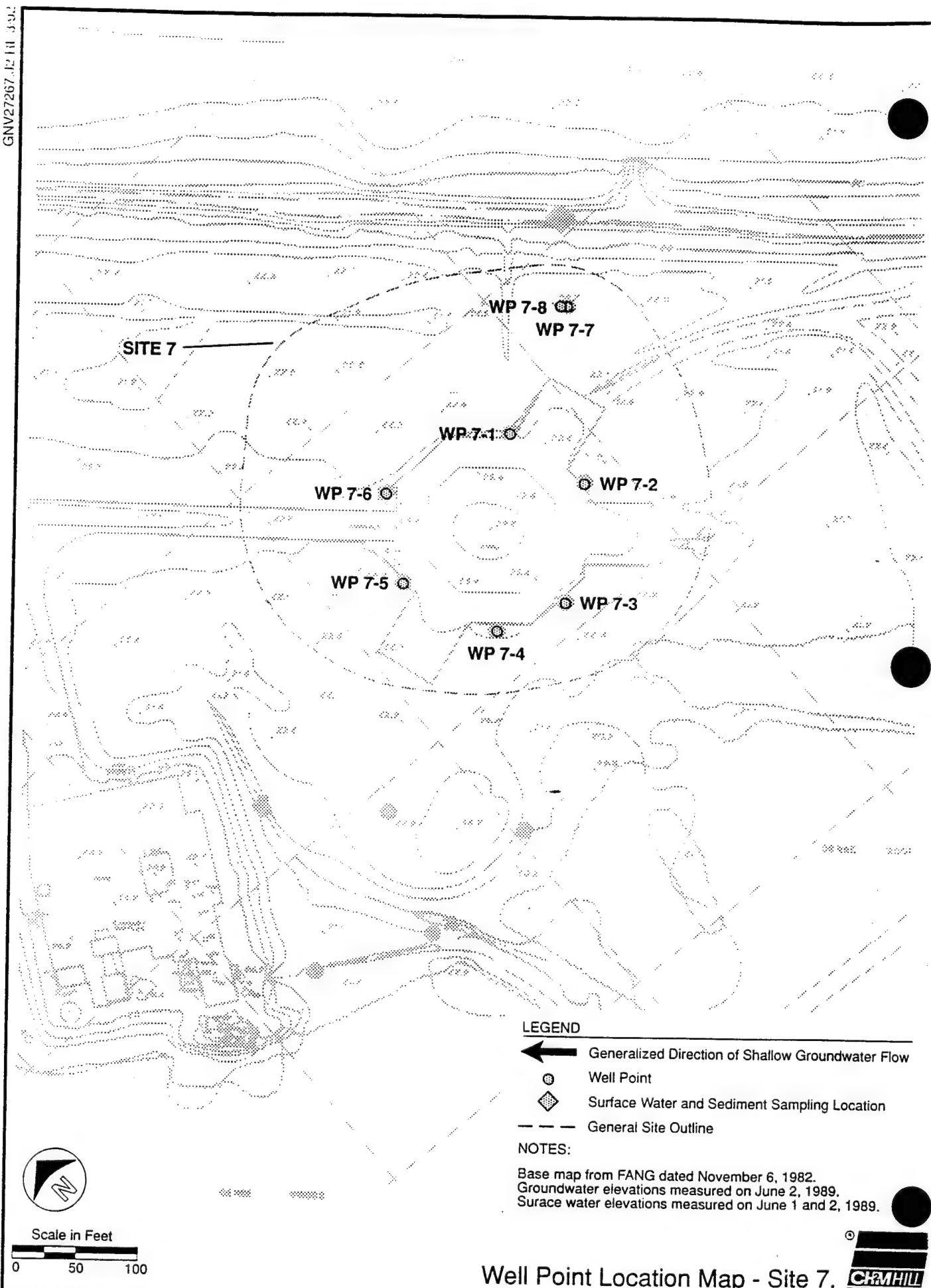
J = Estimated; analyte was present but the reported value may not be accurate or precise.

B = Analyte present in associated blank as well as the sample.

BTEX = Sum of benzene, toluene, ethyl benzene, and xylene concentrations.



Monitor Well Location Map - Site 3E.



**M E M O R A N D U M**

**CH2M HILL**

**TO:** Becky Svatos  
**FROM:** Ann Castleberry  
**DATE:** January 3, 1992  
**SUBJECT:** Florida Air National Guard  
Data Review  
**PROJECT:** GNV27267.J2

**Introduction**

On October 30, a single monitoring well was sampled. This groundwater sample, as well as an equipment rinsate blank and a trip blank, was submitted to the CH2M HILL laboratory located in Montgomery, Alabama for HAZWRAP Level C analysis of volatile organic compounds (VOCs).

Level C data package deliverables included:

- Sample results
- Method blank results
- Tuning and mass calibration summary data
- Initial calibration data
- Continuing calibration data
- Surrogate recovery results
- Surrogate recovery control charts
- Internal standard area summary data

The Level C data were reviewed and validated using the guidance presented in the HAZWRAP document, HWP-65, revision 1. Under HAZWRAP Level C, only summary forms, and not all the raw data, are included in the data package.

**Holding Time**

Holding time is defined as the time in days, from sample collection to sample analysis. The holding time for VOCs is 14 days for an acid-preserved sample. The samples were collected on October 30 and the acid-preserved samples were analyzed on November 10, within the allowable 14 calendar day window.

## **M E M O R A N D U M**

Page 2

January 3, 1992

### **Tuning and Mass Calibration**

The CLP SOW establishes tuning and performance criteria in order to ensure mass resolution, identification, and to some degree sensitivity. These criteria are not sample specific; conformance is determined using bromofluorobenzene (BFB) as a standard material. The instrument was tuned correctly when the samples were analyzed.

### **Calibration**

Initial calibration data are used to demonstrate that the analytical instrument is performing satisfactorily and is capable of producing acceptable quantitative data at the beginning of the analytical period. Continuing calibration checks document that the instrument continues to produce acceptable data.

An acceptable five-point initial calibration was performed on October 3, 1991. An acceptable continuing calibration check sample was analyzed immediately before the field samples. Therefore, the calibration data indicate that the analytical instrument was capable of producing acceptable data before the field samples were analyzed.

### **Internal Standards**

Internal standard compounds are used to ensure that instrument sensitivity and response are stable during each analysis and the acceptance criteria are detailed in the 1988 CLP SOW. Each of the samples were spiked with 3 internal standard compounds: bromochloromethane, 1,4-difluorobenzene, and chlorobenzene. The area count for each internal standard was within the acceptance limits for each of the samples.

### **Surrogate Recovery**

Surrogate spike recoveries are used to monitor laboratory performance and to evaluate matrix interference. Surrogate compounds are the structural homologs of target list compounds (TCL), often TCL compounds with deuterium substituted for hydrogen, and are therefore expected to behave in a similar manner to TCL compounds during analysis. Spike recoveries may also be used to estimate accuracy, which is a measure of the agreement between an experimental determination and the true value of the parameter being measured. Surrogate spike recovery acceptance limits are defined by laboratory-specific control charts.

## M E M O R A N D U M

Page 3

January 3, 1992

Each of the samples were spiked with the 3 surrogate compounds; toluene-d8, 1,4-bromofluorobenzene, and 1,2-dichloroethane-d4. The surrogate spike recoveries were all within the laboratory-specific control chart acceptance limits.

### Blank Samples

Three types of blank samples were analyzed with the groundwater sample.

- **Method Blank**--This blank is American Society of Testing and Materials (ASTM) Type II water that is treated as a sample in the laboratory; in other words, it undergoes the same analytical process as the corresponding samples. Method blanks are used to monitor laboratory performance and contamination introduced during the analytical procedure.
- **Equipment Rinsate Blank**--After the sampling equipment was decontaminated, it was rinsed with ASTM Type II water, and a sample of this final rinse water was submitted as an equipment rinsate blank. This blank was used to monitor contamination that may have been introduced because of incomplete equipment decontamination.
- **Trip Blank**--This was used to monitor possible VOC contamination during the sample container trip. This blank consisted of two 40-ml VOC sample containers (one preserved, one unpreserved), that were filled in the analytical laboratory with ASTM Type II water before being sent to the field with the other sample containers. The trip blank containers were not opened in the field and were shipped back to the laboratory with the other field samples.

Only methylene chloride and acetone were detected in the three blank samples as summarized below.

Sample	[methylene chloride]	[acetone]
Method Blank	5 U	9 BJ
Equipment Rinsate Blank	4 J	12 B
Trip Blank	2 J	5 BJ
MW-3E-1	5	11 B

Acetone was present in all the samples at approximately the same concentration. However, methylene chloride was not detected above the method detection limit in the method blank but was present in the other two blank samples. Methylene

**M E M O R A N D U M**

Page 4

January 3, 1992

chloride was detected in the two field blanks and the groundwater sample at approximately the same concentration. Methylene chloride and acetone are used as extraction solvents in the laboratory; hence, they are common laboratory contaminants. Therefore the acetone and methylene chloride detected in the groundwater sample can be attributed to laboratory contamination.

**Results and Conclusions**

Seven VOCs were detected in the groundwater sample, MW-3E-1; none of these compounds were detected in any of the 3 corresponding blank samples. This data is acceptable as is and can be used in the decision-making process without further qualification.



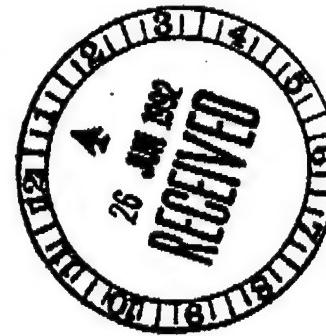
## Florida Department of Environmental Regulation

Twin Towers Office Bldg. • 2600 Blair Stone Road • Tallahassee, Florida 32399-2400  
Lawton Chiles, Governor

Carol M. Browner, Secretary

June 15, 1992

MR RUSSELL DYER  
DEPARTMENT OF THE AIR FORCE  
CODE ANGRC/CERV  
BUILDING 3500  
ANDREWS AFB MD 20331



Dear Mr. Dyer:

Department personnel have completed the review of the April 13, 1992 letter from Mr. Gary L. Hinkle. The letter concerned environmental issues at the Florida Air National Guard, 125th Fighter Interceptor Group, Jacksonville, Florida. I have enclosed a memorandum addressed to me from Dr. James J. Crane. It documents our comments on this matter.

If I can be of any further assistance, please contact me at (904) 488-0190.

Sincerely,

*Eric S. Nuzie*  
Eric S. Nuzie  
Federal Facilities Coordinator

ESN/dd

Enclosure

cc: Brian Cheary  
Jerry Young



State of Florida  
DEPARTMENT OF ENVIRONMENTAL REGULATION

For Routing To Other Than The Addressee			
To:	Location:	To:	Location:
To:	Location:	To:	Location:
To:	Location:	From:	Date:

# Interoffice Memorandum

TO: Eric Nuzie, Federal Facilities Coordinator,  
Bureau of Waste Cleanup

FROM: Dr. James J. Crane, Administrator, Technical  
Review Section, Bureau of Waste Cleanup

DATE: June 2, 1992

SUBJECT: April 13, 1992 Letter From Gary L. Hinkle to  
Eric Nuzie, Florida Air National Guard, 125th  
Fighter Interceptor Group - Review

I've reviewed the subject document and the attached information for Site 3E and Site 7. These comments are submitted in response to the letter's conclusions and recommendations.

In my review comments of a July 29, 1991 information package sent to DER, I'd requested the location of Wellpoint WP7-8 at Site 7. This current information package provides that information. This well was located between the trim pad and the drainageway where an elevated level of chromium was measured. Site 7 does not appear to be a current source of the chromium in the drainage way.

In my September 9, 1991 review comments, I stated that the Total BETX in Well MW-3E-1 was significantly above 50 ppb, i.e., 101 ppb and that this level was too elevated to agree to a no further action. I stated that the well should be maintained in a monitoring only mode in which it would be sampled and analyzed every six months for BETX. If the levels decreased below 50 ppb, a no further action approval would be obtainable.

The current package provides volatile organic data collected on October 30, 1991; the BETX is at 87 ppb, still significantly above 50 ppb. The monitoring only should be continued since no further action is still inappropriate. It has been six months since the last sampling and analysis so the well should be sampled soon.

The other bothersome aspect about this base is that although the individual sites do not seem to be current sources of lead and chromium, elevated levels of these metals in the drainage way sediments and surface waters are a problem.

Eric Nuzie  
June 2, 1992  
Page Two

The Draft Site Investigation Report discusses this issue in the conclusions section under the heading of "drainageway contamination". The discussion acknowledges that there is contamination in the drainageways, that there may be some ecological or environmental risks associated to the levels and that the eight sites may have contributed to this contamination in the past. Other bases under their IRP studies have set up a separate study category such as the drainageway system to address through a ecological risk assessment the overall impact of base activities on the ecological systems. Further sampling and analysis of the drainageway sediments and surface water may be necessary; also an attempt should be made to separate the effects of the nearby airport, if possible.

The Installation Restoration Program has designated the Air Force and State and Federal Trustees as responsible for maintaining and protecting the natural resources; thus, these parties may be involved in the overall issue of the base's impacts on the ecosystems.

/sr



DEPARTMENT OF THE AIR FORCE  
AIR NATIONAL GUARD READINESS CENTER  
ANDREWS AIR FORCE BASE, DC 20331-6008

RECEIVED  
CH2M HILL

AUG 17 1992

MAIL ROOM-COV

AUG 11 1992

Mr. Eric S. Nuzie  
Federal Facilities Coordinator  
Bureau of Waste Cleanup  
Florida Department of Environmental Regulation  
2600 Blair Stone Road  
Tallahassee, Florida 32399-2400

Dear Mr. Nuzie

We have reviewed your letter dated June 15, 1992, and Mr. Jim Crane's memo to you dated June 2, 1992. We will resample monitor well MW3E-1 to see if there have been further decreases in the BTEX concentrations, as you requested.

You expressed concern regarding contamination of the surface water and sediments in the drainage ways at the facility. The facility is currently designing a system to reroute all oil/water separator (OWS) discharges from the drainage ways to the waste water system. Implementation of this change should ensure that the facility is not a source of drainage way contamination.

As Mr. Crane mentioned in his comments to you, runoff from the adjacent Jacksonville International Airport is also a likely source of contamination in the drainage ways. It would be difficult to separate this source from other sources when evaluating drainage way data.

We have already shown there is no clear link between the sites at the facility being investigated under the Installation Restoration Program (IRP) and elevated contaminant levels in surface water and sediment samples from the drainage ways. Additional surface water samples could be collected by the facility after the OWS discharges have been rerouted to confirm improvements in surface water quality.

We will resample monitor well MW3E-1, as you requested, but do not feel additional surface water and sediment sampling in the drainage ways would be beneficial. Following your review of this letter, we request your written concurrence that no further action is necessary under the IRP at Sites 1, 2, 3W, 4, 5, 6, 7 and 8. We would be willing to discuss a sampling program for the drainage ways in conjunction with the planned OWS rerouting.

If you should have any additional questions, please contact our Project Manager, Mr. Michael Minior at (301) 981-8155.

Sincerely

RONALD M. WATSON, Chief  
Environmental Division

cc: 125 FG CC/DE/EM  
HAZWRAP (Mr. White)  
CH2M Hill (Ms Svatos)

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**APPENDIX B**  
*Soil Boring Logs*

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PROJECT NUMBER GNV27267.JX.RI	BORING NUMBER MW 3E-1	SHEET 1 OF 12
<b>SOIL BORING LOG</b>		

PROJECT Florida Air National Guard

LOCATION Jacksonville, Florida

ELEVATION TOC = 24.05 MSL

DRILLING CONTRACTOR IT Corporation, Ocala, Florida

DRILLING METHOD AND EQUIPMENT HSA, Deep Rock XL-11

WATER LEVEL AND DATE 5.50 BTOC on 12/4/89 START 11/27/89 FINISH 11/27/89 LOGGER R. Petersen

DEPTH BELOW SURFACE (FT)	SAMPLE			STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION SOIL NAME, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOLIC LOG	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	INTERVAL	TYPE AND NUMBER	RECOVERY (FT)				
0							
2.5					SAND, dark brown, damp, faint organic odor, fine, loose, (SW-SP)		
5.0					SAND, dark brown to grey brown, wet, medium dense, (SP-SM)		
8.0					SANDY SILT, greyish brown to tan, wet, firm, (SM)		
10					SILTY SAND, grey to pale grey, saturated, fine to medium dense, loose, (SM)		
15.0					End of boring		



PROJECT NUMBER	BORING NUMBER
GNV27267.JX.RI	MW 3E-2
SHEET 2 OF 12	

**SOIL BORING LOG**

PROJECT Florida Air National Guard LOCATION Jacksonville, Florida

ELEVATION TOC = 23.55 MSL DRILLING CONTRACTOR IT Corporation, Ocala, Florida

DRILLING METHOD AND EQUIPMENT HSA, Deep Rock XL-11

WATER LEVEL AND DATE 5.32' BTOC on 12/4/89 START 11/27/89 FINISH 11/27/89 LOGGER R. Petersen

DEPTH BELOW SURFACE (FT)	SAMPLE			STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION SOIL NAME, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOLIC LOG	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	INTERVAL	TYPE AND NUMBER	RECOVERY (FT)				
0							
4.0					SAND, dark brown, damp, fine, loose, (SW-SP)		
5.6					SILTY SAND, dark brown, wet, soft, (SM)	▼	
9.0					SANDY SILT, dark brown to grey, minor clay, wet, firm, (SP-SC)		
15.0					SILTY SAND, light grey, saturated, fine to very fine, soft, (SM)		
					End of boring		



PROJECT NUMBER GNV27267.JX.RI	BORING NUMBER MW 1-1	SHEET 3 OF 12
<b>SOIL BORING LOG</b>		

PROJECT Florida Air National Guard

LOCATION Jacksonville, Florida

ELEVATION TOC = 24.54 MSL

DRILLING CONTRACTOR IT Corporation, Ocala, Florida

DRILLING METHOD AND EQUIPMENT HSA, Deep Rock XL-11

WATER LEVEL AND DATE 4.09' BTOC on 12/5/89 START 11/27/89 FINISH 11/27/89 LOGGER R. Petersen

DEPTH BELOW SURFACE (FT)	SAMPLE			STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION SOIL NAME, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOLIC LOG	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	INTERVAL	TYPE AND NUMBER	RECOVERY (FT)				
0							
5							
6.5							
9.0							
10							
15.0							
					End of boring		



PROJECT NUMBER	BORING NUMBER
GNV27267.JX.RI	MW 1-2
	SHEET 4 OF 12

**SOIL BORING LOG**

PROJECT Florida Air National Guard LOCATION Jacksonville, Florida  
ELEVATION TOC = 22.32 MSL DRILLING CONTRACTOR IT Corporation, Ocala, Florida  
DRILLING METHOD AND EQUIPMENT HSA, Deep Rock XL-11  
WATER LEVEL AND DATE 1.89' BTOC on 12/5/89 START 11/27/89 FINISH 11/27/89 LOGGER R. Petersen

DEPTH BELOW SURFACE (FT)	SAMPLE			STANDARD PENETRATION TEST RESULTS	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS
	INTERVAL	TYPE AND NUMBER	RECOVERY (FT)				
0							
5.0					<u>SAND</u> , black, organic damp roots, fine to medium dense, (SW-SP)		
9.0					<u>SANDY CLAY</u> , dark grey, plastic, samp, stiff, (SC)		
10							
15.0					<u>CLAYEY SILTY SAND</u> , light grey, saturated, soft, (SP-SC)		
15					End of boring		



PROJECT NUMBER	BORING NUMBER
GNV27267.JX.RI	MW 5-1
SOIL BORING LOG	

PROJECT Florida Air National Guard LOCATION Jacksonville, Florida  
ELEVATION TOC = 26.73 MSL DRILLING CONTRACTOR IT Corporation, Ocala, Florida  
DRILLING METHOD AND EQUIPMENT HSA, Deep Rock XL-11  
WATER LEVEL AND DATE 4.22' BTOP on 12/5/89 START 11/28/89 FINISH 11/28/89 LOGGER R. Petersen

DEPTH BELOW SURFACE (FT)	SAMPLE			STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION SOIL NAME, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOLIC LOG	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	INTERVAL	TYPE AND NUMBER	RECOVERY (FT)				
0							
5	6.0				SAND, light brown to tan, damp, fine, loose, (SW-SP)		
9.0					SILTY SAND, dark brown, wet, fine, medium, (SP-SM)		
10							
15.0					SILTY SAND, tan to light grey, saturated, very fine, loose, (SP-SM)		
					End of boring		



PROJECT NUMBER	BORING NUMBER
GNV27267.JX.RI	MW 5-2

SHEET 6 OF 12

## SOIL BORING LOG

PROJECT Florida Air National Guard LOCATION Jacksonville, Florida

ELEVATION TOC = 26.77 MSL DRILLING CONTRACTOR IT Corporation, Ocala, Florida

DRILLING METHOD AND EQUIPMENT HSA, Deep Rock XL-11

WATER LEVEL AND DATE 4.22' BTOS on 12/5/89 START 11/28/89 FINISH 11/28/89 LOGGER R. Petersen

DEPTH BELOW SURFACE (FT)	SAMPLE			STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION SOIL NAME, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOLIC LOG	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	INTERVAL	TYPE AND NUMBER	RECOVERY (FT)				
0							
5.0					SAND, light brown to tan, damp, loose, (SW-SP)		
9.5					SILTY SAND, dark brown, wet, very fine to medium dense, (SP-SM)		
15.0					SILTY SAND, light tan to grey, saturated, very fine, loose (SP-SM)		
					End of boring		



PROJECT NUMBER	BORING NUMBER
GNV27267.JX.RI	MW 6-1
	SHEET 7 OF 12

**SOIL BORING LOG**

PROJECT Florida Air National Guard LOCATION Jacksonville, Florida  
ELEVATION TOC = 27.98 MSL DRILLING CONTRACTOR IT Corporation, Ocala, Florida  
DRILLING METHOD AND EQUIPMENT HSA, Deep Rock XL-11  
WATER LEVEL AND DATE 4.83' BTOC on 12/1/89 START 11/28/89 FINISH 11/28/89 LOGGER R. Petersen

DEPTH BELOW SURFACE (FT)	SAMPLE			STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION SOIL NAME, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOLIC LOG	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	INTERVAL	TYPE AND NUMBER	RECOVERY (FT)				
0							
6.0					SAND, tan to light grey, damp, fine, loose, (SW-SP)		
11.0					SILTY SAND, tan, wet, very fine to medium dense, (SP-SM)		
15.0					SILTY SAND, tan, saturated, medium dense, (SP-SM)		
					End of boring		



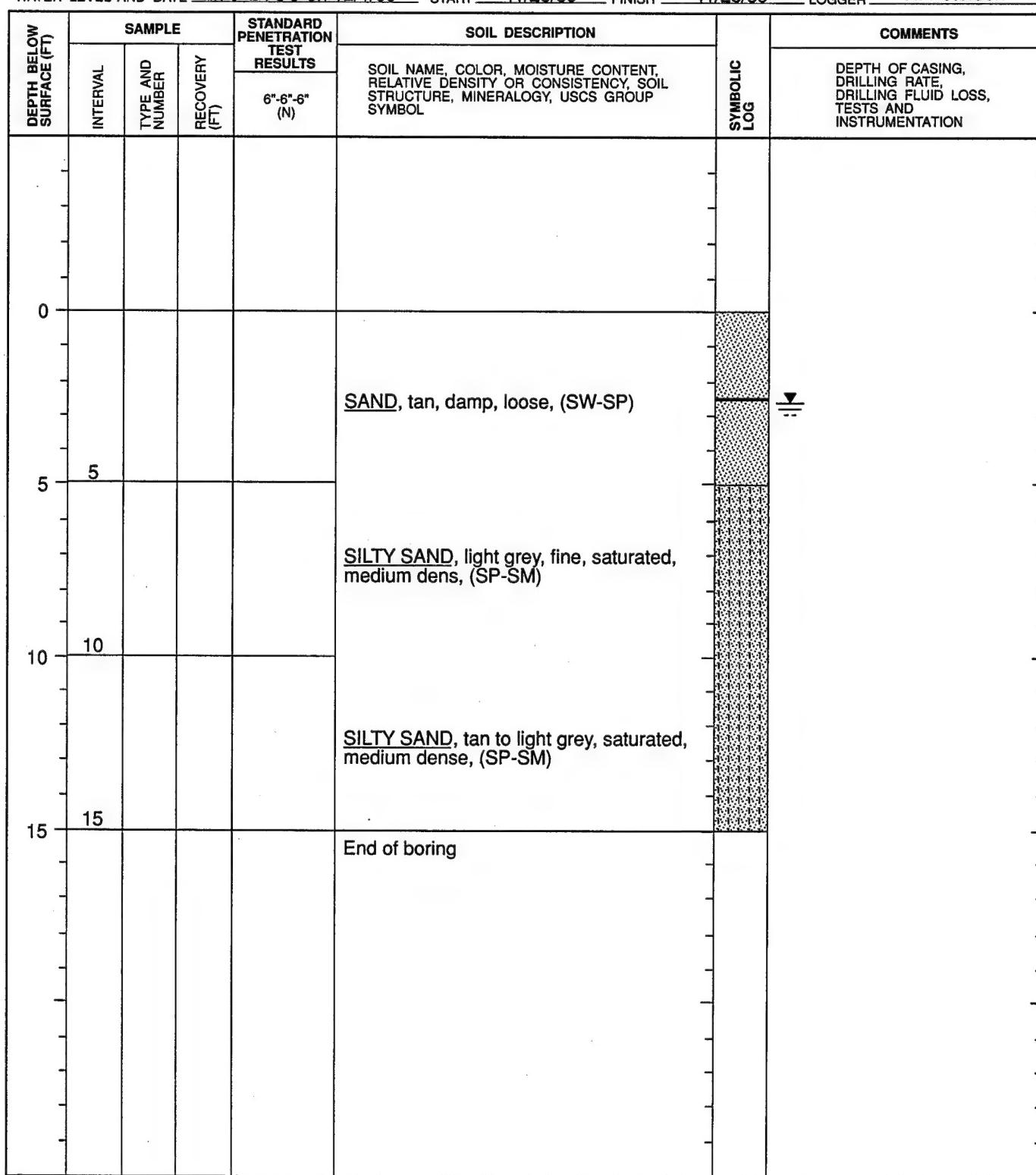
PROJECT NUMBER GNV27267.JX.RI	BORING NUMBER MW 6-2	SHEET 8 OF 12
<b>SOIL BORING LOG</b>		

PROJECT Florida Air National Guard LOCATION Jacksonville, Florida

ELEVATION TOC = 25.54 MSL DRILLING CONTRACTOR IT Corporation, Ocala, Florida

DRILLING METHOD AND EQUIPMENT HSA, Deep Rock XL-11

WATER LEVEL AND DATE 2.70' BTOP on 12/1/89 START 11/28/89 FINISH 11/28/89 LOGGER R. Petersen





PROJECT NUMBER	BORING NUMBER
GNV27267.JX.RI	MW 8-1
SHEET 9 OF 12	

**SOIL BORING LOG**

PROJECT Florida Air National Guard LOCATION Jacksonville, Florida  
ELEVATION TOC = 23.86 MSL DRILLING CONTRACTOR IT Corporation, Ocala, Florida  
DRILLING METHOD AND EQUIPMENT HSA, Deep Rock XL-11  
WATER LEVEL AND DATE 2.05' BTOP on 12/5/89 START 11/28/89 FINISH 11/28/89 LOGGER R. Petersen

DEPTH BELOW SURFACE (FT)	SAMPLE			STANDARD PENETRATION TEST RESULTS	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS
	INTERVAL	TYPE AND NUMBER	RECOVERY (FT)				
0							
3.0	SS-1	1.5	11-10-10-9 (20)		SAND, dark brown, damp, fine to medium dense, (SW-SP)		
5.0	SS-2	1.2	7-6-4-4 (10)		SILTY SAND, tan to light grey, wet, loose, (SM)		
7.0					SILTY SAND, tan to light grey, wet, loose, (SM)		
11.0					SANDY CLAY, dark grey, plastic, wet, firm, (SC)		
15.0					SILTY SAND, light grey, wet, soft, (SP-SM)		
					End of boring		



PROJECT NUMBER GNV27267.JX.RI	BORING NUMBER MW 8-2
	SHEET 10 OF 12

**SOIL BORING LOG**

PROJECT Florida Air National Guard LOCATION Jacksonville, Florida  
ELEVATION TOC = 24.00 MSL DRILLING CONTRACTOR IT Corporation, Ocala, Florida  
DRILLING METHOD AND EQUIPMENT HSA, Deep Rock XL-11  
WATER LEVEL AND DATE 2.29' BTOC on 12/5/89 START 11/28/89 FINISH 11/28/89 LOGGER R. Petersen

DEPTH BELOW SURFACE (FT)	SAMPLE			STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION SOIL NAME, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOLIC LOG	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	INTERVAL	TYPE AND NUMBER	RECOVERY (FT)				
0	1.0						
3.0	SS-1	1.5	7-10-9-11 (19)		SAND, tan to light grey, damp, fine, medium dense, (SW-SP)		
5.0	SS-2	1.5	7-5-4-4 (9)		SAND, light grey, wet, loose, fine to medium dense, (SW-SP)		
8.0					SILTY SAND, dark brown, saturated, fine to medium dense, (SM)		
10					SILTY CLAYEY SAND, grey, plastic, saturated, firm, (SC)		
12.5					SILTY SAND, light grey, saturated, soft, (SP-SM)		
15					End of boring		



PROJECT NUMBER GNV27267.JX.RI	BORING NUMBER MW 8-3
SHEET 11 OF 12	
<b>SOIL BORING LOG</b>	

PROJECT Florida Air National Guard LOCATION Jacksonville, Florida  
ELEVATION TOC = 24.05 MSL DRILLING CONTRACTOR IT Corporation, Ocala, Florida  
DRILLING METHOD AND EQUIPMENT HSA, Deep Rock XL-11  
WATER LEVEL AND DATE 2.48' BTOP on 12/5/89 START 11/28/89 FINISH 11/28/89 LOGGER R. Petersen

DEPTH BELOW SURFACE (FT)	SAMPLE			STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION SOIL NAME, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOLIC LOG	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	INTERVAL	TYPE AND NUMBER	RECOVERY (FT)				
0	1.0						
3.0	SS-1	1.5	10-16-14-16 (30)		SAND, brown to dark grey, damp, fine to medium dense, (SW-SP)		
5.0	SS-2	1.4	6-11-8-6 (19)		SAND, light brown to pale grey, wet, fine to medium dense, (SW-SP)		
8.0					SAME AS ABOVE, (SW-SP)		
10							
15.0					SILTY SAND, greyish blue, trace of clay, wet, soft, very fine, (SM)		
					End of boring		



PROJECT NUMBER	BORING NUMBER
GNV27267.JX.RI	SB 8-5
	SHEET 12 OF 12

**SOIL BORING LOG**

PROJECT Florida Air National Guard LOCATION Jacksonville, Florida

ELEVATION N/A DRILLING CONTRACTOR IT Corporation, Ocala, Florida

DRILLING METHOD AND EQUIPMENT HSA, Deep Rock XL-11

WATER LEVEL AND DATE N/A START 11/28/89 FINISH 11/28/89 LOGGER R. Petersen

DEPTH BELOW SURFACE (FT)	SAMPLE			STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION SOIL NAME, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOLIC LOG	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	INTERVAL	TYPE AND NUMBER	RECOVERY (FT)				
0	1.0						
3.0	SS-1	1.5	9-12-16-14 (28)		SAND, light grey to brown, damp, fine to medium dense, (SW-SP)		
5.0	SS-2	1.4	8-9-7-6 (16)		SAME AS ABOVE, (SW-SP)		Soil boring only. No monitor well installed and no water level measured.

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**APPENDIX C**  
*Cone Penetrometer Test Data*

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**IN-SITU TECHNOLOGY SOIL BEHAVIOR TABLE  
FOR FLORIDA AND FLORIDA TYPE SOILS**

JOB NAME ..... FLORIDA AIR GAURO CH2MHILL  
 JOB FILE NUMBER... GNV27267.JX.SI  
 CONE SOUNDING.... PC1-1

DEPTH FEET	SOIL BEHAVIOR TYPE	QC (KG/CM <sup>2</sup> )	LF (KG/CM <sup>2</sup> )	N' VALUES	VERTICAL EFFECTIVE STRESS (KG/CM <sup>2</sup> )	RELATIVE DENSITY (%)	FRICTION ANGLE (DEGREES)	YOUNGS MODULUS (KG/CM <sup>2</sup> )	UNDRAINED SHEAR STRENGTH (KG/CM <sup>2</sup> )	SENSITIVITY	COMP.	OCR	#	*	**	***	****
													#	*	**	***	****
1	SILTY TO CLAYEY F.S.	39.6	.28	13 9	.048	60%-70%	38-48	87	-	-	-	-	-	-	-	-	-
2	SILTY TO CLAYEY F.S.	24.4	.13	8 5	.097	50%-60%	44-46	53	-	-	-	-	-	-	-	-	-
3	SENSITIVE FINE GRAINED	6.9	.06	3 2	.131	-	-	-	.42	10.7	.02	6	-	-	-	-	-
4	SENSITIVE FINE GRAINED	3.1	.03	1 1	.166	-	-	-	.18	8.4	.06	6	-	-	-	-	-
5	SOFT CLAY TO MUCK	5.4	.1	3 1	.209	-	-	-	.32	5.4	.04	6	-	-	-	-	-
6	CLAYEY FINE SAND	17.5	.22	7 4	.24	40%-50%	38-40	38	-	-	-	-	-	-	-	-	-
7	FINE SAND	105.2	.24	21 22	.273	70%-80%	46-48	231	-	-	-	-	-	-	-	-	-
8	SILTY FINE SAND	65	.11	16 13	.304	60%-70%	44-46	143	-	-	-	-	-	-	-	-	-
9	FINE SAND	77.5	.13	15 16	.337	70%-80%	44-46	170	-	-	-	-	-	-	-	-	-
10	SILTY TO CLAYEY F.S.	28.3	.06	9 6	.368	40%-50%	38-40	62	-	-	-	-	-	-	-	-	-
11	FINE SAND	120.1	.27	24 25	.401	70%-80%	44-46	264	-	-	-	-	-	-	-	-	-
12	SILTY TO CLAYEY F.S.	56.2	.62	18 14	.432	60%-70%	42-44	123	-	-	-	-	-	-	-	-	-
13	FINE SAND	91.2	.41	18 20	.465	70%-80%	42-44	200	-	-	-	-	-	-	-	-	-
14	SILTY FINE SAND	73.1	.58	18 17	.496	60%-70%	42-44	160	-	-	-	-	-	-	-	-	-
15	FINE SAND	113.6	.38	22 24	.529	70%-80%	44-46	249	-	-	-	-	-	-	-	-	-
16	FINE SAND	155.2	.75	31 34	.563	80%-90%	44-46	341	-	-	-	-	-	-	-	-	-
17	FINE SAND	124.3	.88	24 28	.596	70%-80%	44-46	273	-	-	-	-	-	-	-	-	-
18	FINE SAND	123	.8	24 28	.629	70%-80%	42-44	270	-	-	-	-	-	-	-	-	-
19	FINE SAND	110.9	.99	22 26	.662	70%-80%	42-44	243	-	-	-	-	-	-	-	-	-
20	FINE SAND	124.7	.84	24 28	.695	70%-80%	42-44	274	-	-	-	-	-	-	-	-	-
21	FINE SAND	160.8	1	32 36	.729	80%-90%	44-46	353	-	-	-	-	-	-	-	-	-
22	FINE SAND	122.6	1.2	24 29	.762	70%-80%	42-44	269	-	-	-	-	-	-	-	-	-
23	FINE SAND	131.7	.92	26 30	.795	70%-80%	42-44	289	-	-	-	-	-	-	-	-	-
24	SOFT CLAY TO MUCK	22.5	.83	15 8	.822	-	-	-	1.31	2.6	UD	6	-	-	-	-	-
25	CLAYEY FINE SAND	29.9	.51	11 8	.853	(40%	34-36	65	-	-	-	-	-	-	-	-	-
26	FINE SAND	94.4	.56	18 21	.886	60%-70%	40-42	207	-	-	-	-	-	-	-	-	-
27	SILTY FINE SAND	114	1.68	28 30	.917	60%-70%	40-42	250	-	-	-	-	-	-	-	-	-
28	FINE SAND	144.3	1.14	28 33	.95	70%-80%	42-44	317	-	-	-	-	-	-	-	-	-
29	CEMENTED SAND TO HARDPAN	231.9	.67	38 49	.987	190%	44-46	510	-	-	-	-	-	-	-	-	-
30	CEMENTED SAND TO HARDPAN	217.9	1	36 48	1.024	80%-90%	44-46	479	-	-	-	-	-	-	-	-	-
31	FINE SAND	216.1	1.34	43 49	1.057	80%-90%	44-46	475	-	-	-	-	-	-	-	-	-
32	FINE SAND	113.4	.6	22 25	1.09	60%-70%	40-42	249	-	-	-	-	-	-	-	-	-
33	FINE SAND	102.3	.43	20 22	1.123	50%-60%	40-42	225	-	-	-	-	-	-	-	-	-
34	FINE SAND	103.3	.59	20 23	1.156	50%-60%	40-42	227	-	-	-	-	-	-	-	-	-
35	FINE SAND	124.7	.78	24 28	1.19	60%-70%	40-42	274	-	-	-	-	-	-	-	-	-
36	FINE SAND	115.2	.68	23 26	1.223	60%-70%	40-42	253	-	-	-	-	-	-	-	-	-
37	SILTY FINE SAND	63.1	.46	15 14	1.254	(40%	36-38	138	-	-	-	-	-	-	-	-	-
38	FINE SAND	117.6	.5	23 26	1.287	50%-60%	40-42	258	-	-	-	-	-	-	-	-	-
39	FINE SAND	106.3	.67	21 24	1.32	50%-60%	40-42	233	-	-	-	-	-	-	-	-	-
40	FINE SAND	95.8	.57	19 21	1.353	40%-50%	38-40	210	-	-	-	-	-	-	-	-	-

41	SILTY FINE SAND	88.4	.5	22	20	1.384	40%-50%	38-40	194	—	—	—
42	FINE SAND	123.6	.61	24	27	1.417	50%-60%	40-42	271	—	—	—
43	SILTY TO CLAYEY F.S.	40.8	.45	13	10	1.448	(40%)	34-36	89	—	—	—
44	SILTY TO CLAYEY F.S.	36.5	.12	12	8	1.479	(40%)	32-34	80	—	—	—
45	FINE SAND	124.2	.13	24	25	1.512	50%-60%	40-42	273	—	—	—
46	FINE SAND	103.1	.02	20	21	1.545	40%-50%	38-40	226	—	—	—
47	FINE SAND	129.7	.02	25	26	1.578	50%-60%	40-42	285	—	—	—
48	FINE SAND	94.2	.6	18	21	1.612	40%-50%	38-40	207	—	—	—
49	FINE SAND	109.5	.83	21	25	1.645	40%-50%	38-40	240	—	—	—
50	SILTY FINE SAND	100.6	1.18	25	25	1.676	40%-50%	38-40	221	—	—	—
51	FINE SAND	152.3	1.13	30	35	1.709	60%-70%	40-42	335	—	—	—
52	SILTY FINE SAND	79.8	.73	19	19	1.74	(40%)	36-38	175	—	—	—
53	SILTY TO CLAYEY F.S.	59.9	.85	19	15	1.77	(40%)	34-36	131	—	—	—
54	SILTY FINE SAND	81.3	.34	20	18	1.801	(40%)	36-38	178	—	—	—
55	FINE SAND	165.5	.37	33	35	1.834	60%-70%	40-42	364	—	—	—
56	FINE SAND	124	.43	24	27	1.867	40%-50%	38-40	272	—	—	—
57	FINE SAND	167.5	.46	33	35	1.901	60%-70%	40-42	368	—	—	—
58	FINE SAND	102.1	.45	20	22	1.934	40%-50%	36-38	224	—	—	—
59	SILTY VINE SAND	98.3	1.23	24	25	1.965	(40%)	36-38	216	—	—	—
60	CLAYEY FINE SAND	36.1	.93	14	11	1.995	(40%)	30-32	79	—	—	—
61	SOFT CLAY TO MUCK	21	.82	14	7	2.023	—	—	—	1.07	2.5	UD
62	FINE SAND	96	.64	19	22	2.056	(40%)	36-38	211	—	—	—
63	SILTY FINE SAND	74.3	.91	18	19	2.087	(40%)	34-36	163	—	—	—
64	SILTY TO CLAYEY F.S.	58.6	.92	19	15	2.118	(40%)	34-36	128	—	—	—
65	SILTY FINE SAND	91.1	1.25	22	23	2.148	(40%)	36-38	200	—	—	—
66	SILTY FINE SAND	114.1	1.26	28	28	2.179	40%-50%	36-38	251	—	—	—
67	SILTY TO CLAYEY F.S.	66.6	.85	22	17	2.21	(40%)	34-36	146	—	—	—
68	SILTY TO CLAYEY F.S.	42.2	.3	14	10	2.241	(40%)	30-32	92	—	—	—
69	SILTY FINE SAND	47.5	.18	11	10	2.271	(40%)	30-32	104	—	—	—
70	SILTY FINE SAND	46.8	.17	11	10	2.302	(40%)	30-32	102	—	—	—
71	SILTY FINE SAND	46.7	.21	11	10	2.333	(40%)	30-32	102	—	—	—
72	SILTY FINE SAND	44.1	.24	11	10	2.364	(40%)	30-32	97	—	—	—
73	SILTY TO CLAYEY F.S.	39.7	.31	13	9	2.394	(40%)	30-32	87	—	—	—
74	SILTY TO CLAYEY F.S.	39.9	.27	13	9	2.425	(40%)	30-32	87	—	—	—
75	SILTY TO CLAYEY F.S.	33	.44	11	8	2.456	(40%)	(30)	72	—	—	—
76	SILTY FINE SAND	56.8	.45	14	13	2.487	(40%)	32-34	124	—	—	—
77	SILTY TO CLAYEY F.S.	42	.66	14	11	2.517	(40%)	30-32	92	—	—	—
78	FINE SAND	107.6	.77	21	25	2.551	(40%)	36-38	236	—	—	—
79	FINE SAND !	120	.88	24	28	2.584	40%-50%	36-38	264	—	—	—
80	SILTY TO CLAYEY F.S.	69.8	1.12	23	18	2.615	(40%)	32-34	153	—	—	—
81	SILTY TO CLAYEY F.S.	60.4	.7	20	15	2.645	(40%)	32-34	132	—	—	—
82	SILTY TO CLAYEY F.S.	49.5	.52	16	12	2.676	(40%)	30-32	108	—	—	—
83	SILTY FINE SAND	80.6	.72	20	19	2.707	(40%)	34-36	177	—	—	—
84	SILTY TO CLAYEY F.S.	61.3	.83	20	16	2.738	(40%)	32-34	134	—	—	—
85	SILTY FINE SAND	85.4	1.14	21	22	2.768	(40%)	34-36	187	—	—	—
86	SILTY FINE SAND	96.3	1.06	24	24	2.799	(40%)	34-36	211	—	—	—
87	CLAYEY FINE SAND	45.3	1.07	18	13	2.83	(40%)	30-32	99	—	—	—
88	SILTY TO CLAYEY F.S.	25.2	.13	8	6	2.861	(40%)	(30)	55	—	—	—
89	SILTY TO CLAYEY F.S.	37.8	.23	12	8	2.892	(40%)	(30)	83	—	—	—

\* N' = POINT STRESS \* (.2 + .04 \* FRICTION RATIO)

\* NORMALLY CONSOLIDATED SANDS

\*\* FOR OVERCONSOLIDATED SANDS, SLIGHTLY REDUCE ABOVE FRICTION ANGLES

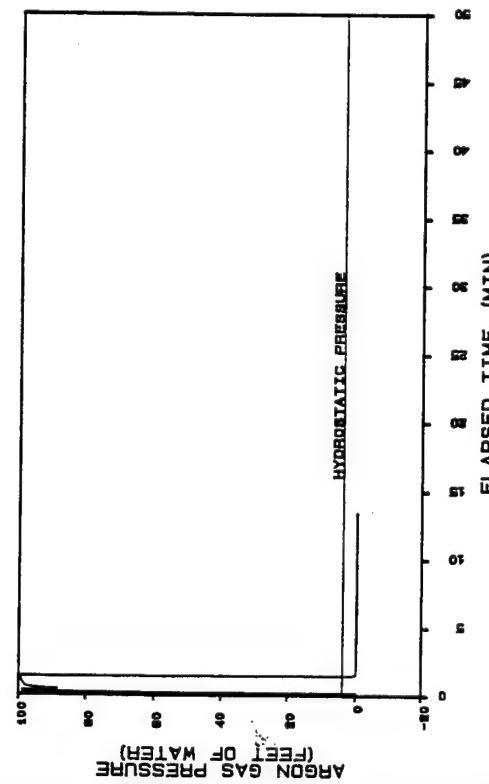
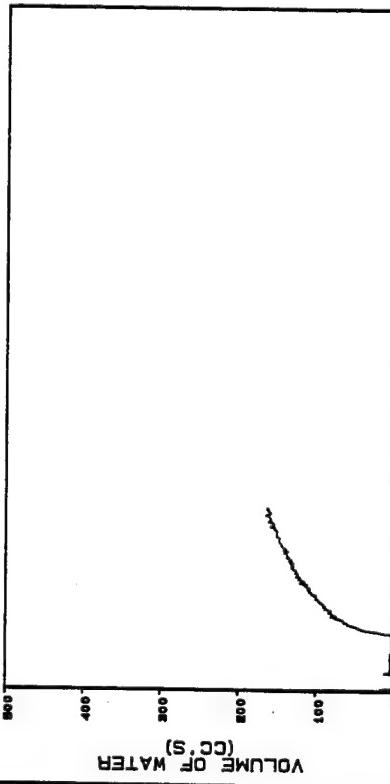
\*\*\* FOR OVERCONSOLIDATED SANDS, YOUNG'S MODULUS MAY BE AS MUCH AS 3 TO 6 TIMES HIGHER

\*\*\*\* NK OF 16 USED. FOR OVERCONSOLIDATED CLAYS, AN NK OF 17 IS SUGGESTED

THE ABOVE DATA WAS COMPUTED FOLLOWING 'BASIC' GUIDELINES BY P. K. ROBERTSON AND R. G. CAMPANELLA IN THE HANDBOOK  
 'GUIDELINES FOR USE AND INTERPRETATION OF THE ELECTRONIC CONE PENETRATION TEST'  
 SEPTEMBER, 1984

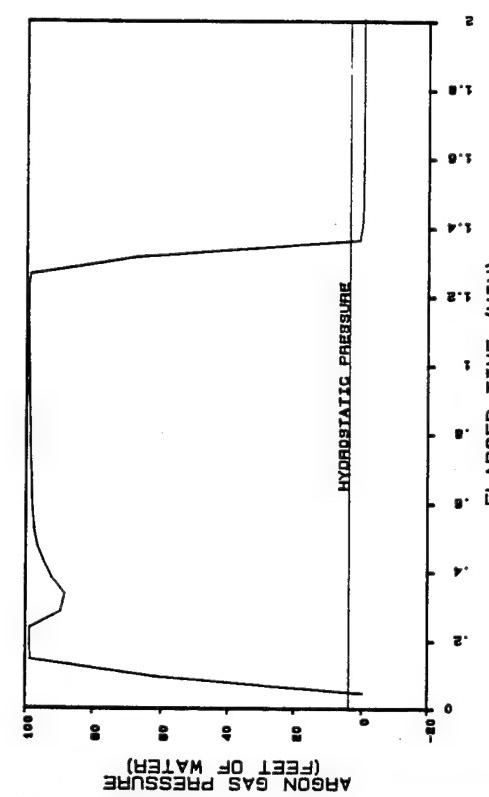
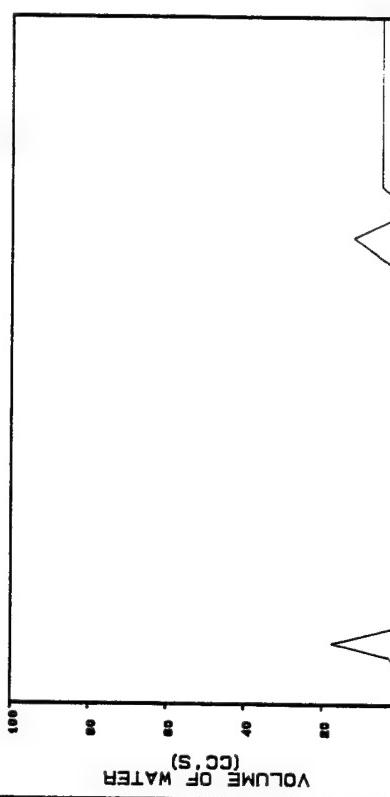
ADDITIONAL LOCAL CORRELATIONS DEVELOPED BY IN-SITU TECHNOLOGY HAVE ALSO BEEN USED IN COMPUTING THE ABOVE DATA.  
 IT IS THE POLICY OF IN-SITU TECHNOLOGY TO CONTINUALLY UPGRADE AND MODIFY C.P.T CORRELATIONS AS  
 PUBLISHED RESEARCH AND LOCAL EXPERIENCE GROWS.

**HYDROCONE TEST**



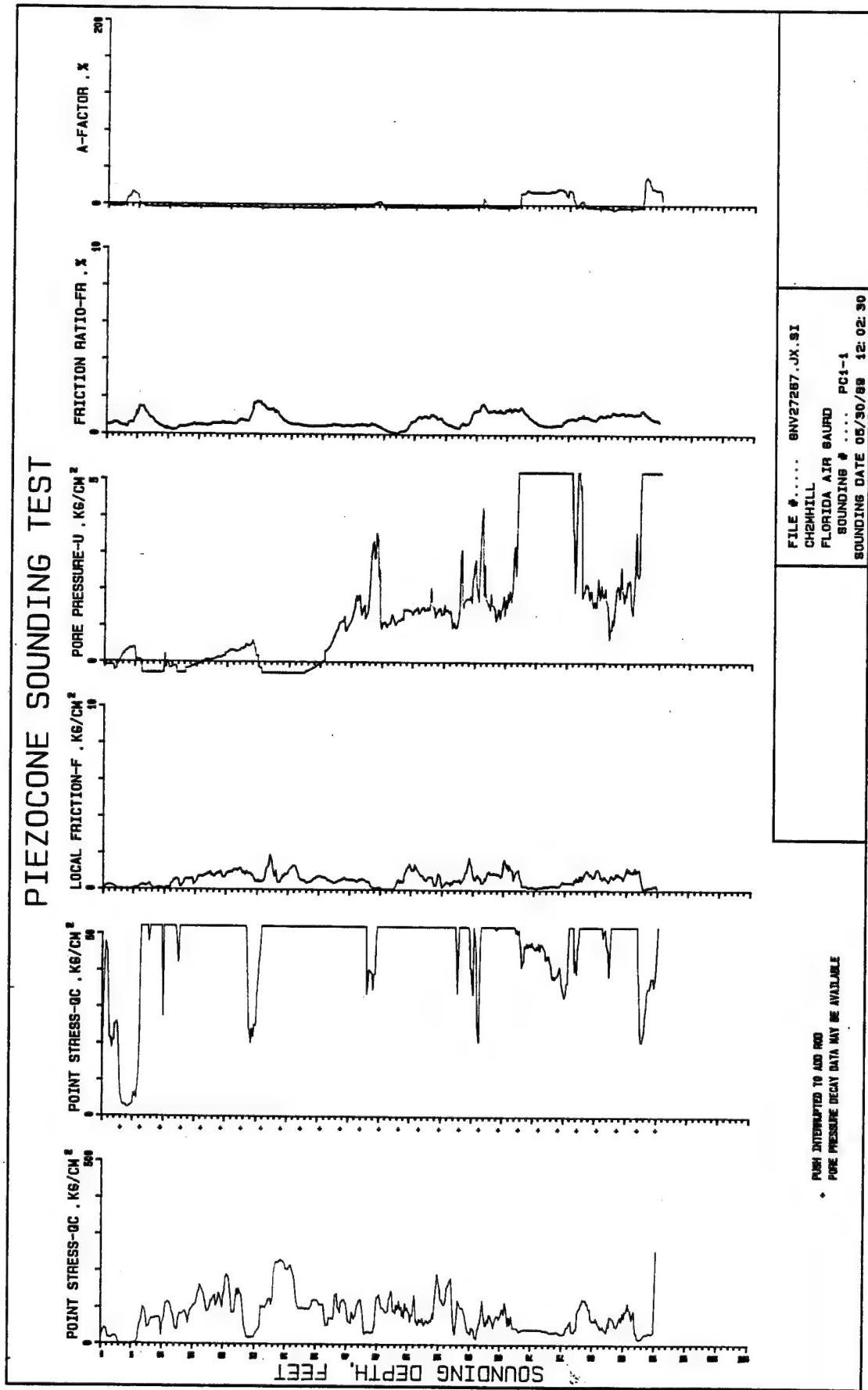
CH2MHILL LOCATION... HC1-1 TEST DATE 05/30/88 14: 06: 40	SAMPLE DEPTH (FT) 7 GROUNDWATER DEPTH (FT) 4
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**HYDROCONE TEST**



CH2MHILL LOCATION... HC1-1 TEST DATE 05/30/88 14: 06: 40	SAMPLE DEPTH (FT) 7 GROUNDWATER DEPTH (FT) 4
---	---

# PIEZOCONE SOUNDING TEST



FILE #	BKV27287.JX.S1
CHINHILL	
FLORIDA AIR SAUDI	
BOUNDRY #	PC1-1
OUNDING DATE	05/30/89 12:02:30

PUSH INTERRUPTED TO ADD ROD  
PORE PRESSURE DECAY DATA MAY BE AVAILABLE

---

**APPENDIX D**  
*Slug Test Data and Hydraulic  
Conductivity Calculations*

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Florida Air National Guard Step 2 Site Investigation  
Slug Test Data  
MW 3E-2

Slug In

Slug Out

TIME	TRANSDUCER READING (FEET)	ELAPSED TIME (SEC)	WATER LEVEL CHANGE (FEET)	TRANSDUCER READING (FEET)	ELAPSED TIME (SEC)	WATER LEVEL CHANGE (FEET)
09:00:00 AM	10.83			09:26:00 AM	11	
09:01:00 AM	10.83			09:27:00 AM	11	
09:01:00 AM	10.84			09:28:00 AM	11	
09:03:00 AM	10.85			09:28:00 AM	10.99	
09:03:01 AM	10.85			09:30:00 AM	10.99	
09:03:02 AM	11.37			09:30:01 AM	10.97	
09:03:03 AM	11.43			09:30:02 AM	9.81	
09:03:04 AM	11.79			09:30:03 AM	9.34	0 1.65
09:03:05 AM	12.08			09:30:04 AM	9.4	1 1.59
09:03:06 AM	12.26			09:30:05 AM	9.44	2 1.55
09:03:07 AM	12.34	0	1.49	09:30:06 AM	9.29	3 1.7
09:03:08 AM	12.12	1	1.27	09:30:07 AM	9.52	4 1.47
09:03:09 AM	12.21	2	1.36	09:30:08 AM	9.59	5 1.4
09:03:10 AM	12.14	3	1.29	09:30:09 AM	9.63	6 1.36
09:03:11 AM	12.12	4	1.27	09:30:10 AM	9.66	7 1.33
09:03:12 AM	12.09	5	1.24	09:30:11 AM	9.7	8 1.29
09:03:13 AM	12.25	6	1.4	09:30:12 AM	9.72	9 1.27
09:03:14 AM	12.09	7	1.24	09:30:13 AM	9.75	10 1.24
09:03:15 AM	12.02	8	1.17	09:30:14 AM	9.77	11 1.22
09:03:16 AM	11.95	9	1.1	09:30:15 AM	9.8	12 1.19
09:03:17 AM	11.98	10	1.13	09:30:16 AM	9.83	13 1.16
09:03:18 AM	11.94	11	1.09	09:30:17 AM	9.84	14 1.15
09:03:19 AM	11.91	12	1.06	09:30:18 AM	9.87	15 1.12
09:03:20 AM	11.95	13	1.1	09:30:19 AM	9.9	16 1.09
09:03:21 AM	11.88	14	1.03	09:30:20 AM	9.91	17 1.08
09:03:22 AM	11.76	15	0.91	09:30:21 AM	9.93	18 1.06
09:03:23 AM	11.84	16	0.99	09:30:22 AM	9.96	19 1.03
09:03:24 AM	11.85	17	1	09:30:23 AM	9.97	20 1.02
09:03:25 AM	11.79	18	0.94	09:30:24 AM	9.99	21 1
09:03:26 AM	11.74	19	0.89	09:30:25 AM	10.01	22 0.98
09:03:27 AM	11.77	20	0.92	09:30:26 AM	10.03	23 0.96
09:03:28 AM	11.78	21	0.93	09:30:27 AM	10.04	24 0.95
09:03:29 AM	11.74	22	0.89	09:30:28 AM	10.06	25 0.93
09:03:30 AM	11.74	23	0.89	09:30:29 AM	10.08	26 0.91
09:03:31 AM	11.72	24	0.87	09:30:30 AM	10.09	27 0.9
09:03:32 AM	11.71	25	0.86	09:30:31 AM	10.1	28 0.89
09:03:33 AM	11.69	26	0.84	09:30:32 AM	10.12	29 0.87
09:03:34 AM	11.69	27	0.84	09:30:33 AM	10.13	30 0.86
09:03:35 AM	11.68	28	0.83	09:30:34 AM	10.15	31 0.84
09:03:36 AM	11.66	29	0.81	09:30:35 AM	10.16	32 0.83
09:03:37 AM	11.65	30	0.8	09:30:36 AM	10.17	33 0.82
09:03:38 AM	11.71	31	0.86	09:30:37 AM	10.18	34 0.81
09:03:39 AM	11.6	32	0.75	09:30:38 AM	10.2	35 0.79
09:03:40 AM	11.54	33	0.69	09:30:39 AM	10.21	36 0.78
09:03:41 AM	11.66	34	0.81	09:30:40 AM	10.22	37 0.77
09:03:42 AM	11.61	35	0.76	09:30:41 AM	10.23	38 0.76
09:03:43 AM	11.58	36	0.73	09:30:42 AM	10.24	39 0.75
09:03:44 AM	11.59	37	0.74	09:30:43 AM	10.25	40 0.74
09:03:45 AM	11.58	38	0.73	09:30:44 AM	10.26	41 0.73
09:03:46 AM	11.57	39	0.72	09:30:45 AM	10.27	42 0.72
09:03:47 AM	11.57	40	0.72	09:30:46 AM	10.28	43 0.71
09:03:48 AM	11.56	41	0.71	09:30:47 AM	10.28	44 0.71
09:03:49 AM	11.55	42	0.7	09:30:48 AM	10.29	45 0.7

09:03:50 AM	11.54	43	0.69	09:30:49 AM	10.31	46	0.68
09:03:51 AM	11.54	44	0.69	09:30:50 AM	10.32	47	0.67
09:03:52 AM	11.53	45	0.68	09:30:51 AM	10.32	48	0.67
09:03:53 AM	11.52	46	0.67	09:30:52 AM	10.33	49	0.66
09:03:54 AM	11.51	47	0.66	09:30:53 AM	10.34	50	0.65
09:03:55 AM	11.51	48	0.66	09:30:54 AM	10.35	51	0.64
09:03:56 AM	11.5	49	0.65	09:30:55 AM	10.35	52	0.64
09:03:57 AM	11.5	50	0.65	09:30:56 AM	10.36	53	0.63
09:03:58 AM	11.49	51	0.64	09:30:57 AM	10.37	54	0.62
09:03:59 AM	11.49	52	0.64	09:30:58 AM	10.38	55	0.61
09:04:00 AM	11.48	53	0.63	09:30:59 AM	10.38	56	0.61
09:04:10 AM	11.44	63	0.59	09:31:00 AM	10.39	57	0.6
09:04:20 AM	11.4	73	0.55	09:31:10 AM	10.44	67	0.55
09:04:30 AM	11.37	83	0.52	09:31:20 AM	10.48	77	0.51
09:04:40 AM	11.35	93	0.5	09:31:30 AM	10.52	87	0.47
09:04:50 AM	11.33	103	0.48	09:31:40 AM	10.54	97	0.45
09:05:00 AM	11.32	113	0.47	09:31:50 AM	10.56	107	0.43
09:05:10 AM	11.31	123	0.46	09:32:00 AM	10.58	117	0.41
09:05:20 AM	11.3	133	0.45	09:32:10 AM	10.6	127	0.39
09:05:30 AM	11.29	143	0.44	09:32:20 AM	10.61	137	0.38
09:05:40 AM	11.29	153	0.44	09:32:30 AM	10.61	147	0.38
09:05:50 AM	11.28	163	0.43	09:32:40 AM	10.62	157	0.37
09:06:00 AM	11.27	173	0.42	09:32:50 AM	10.63	167	0.36
09:06:10 AM	11.26	183	0.41	09:33:00 AM	10.64	177	0.35
09:06:20 AM	11.25	193	0.4	09:33:10 AM	10.65	187	0.34
09:06:30 AM	11.25	203	0.4	09:33:20 AM	10.65	197	0.34
09:06:40 AM	11.25	213	0.4	09:33:30 AM	10.66	207	0.33
09:06:50 AM	11.24	223	0.39	09:33:40 AM	10.66	217	0.33
09:07:00 AM	11.23	233	0.38	09:33:50 AM	10.67	227	0.32
09:07:10 AM	11.23	243	0.38	09:34:00 AM	10.67	237	0.32
09:07:20 AM	11.22	253	0.37	09:34:10 AM	10.67	247	0.32
09:07:30 AM	11.21	263	0.36	09:34:20 AM	10.67	257	0.32
09:07:40 AM	11.21	273	0.36	09:34:30 AM	10.67	267	0.32
09:07:50 AM	11.2	283	0.35	09:34:40 AM	10.68	277	0.31
09:09:00 AM	11.18	353	0.33	09:34:50 AM	10.68	287	0.31
09:10:00 AM	11.15	413	0.3	09:36:00 AM	10.7	357	0.29
09:11:00 AM	11.13	473	0.28	09:37:00 AM	10.72	417	0.27
09:12:00 AM	11.11	533	0.26	09:38:00 AM	10.73	477	0.26
09:13:00 AM	11.09	593	0.24	09:39:00 AM	10.73	537	0.26
09:14:00 AM	11.08	653	0.23	09:40:00 AM	10.74	597	0.25
09:15:00 AM	11.07	713	0.22				
09:16:00 AM	11.05	773	0.2				
09:17:00 AM	11.05	833	0.2				
09:18:00 AM	11.04	893	0.19				
09:19:00 AM	11.04	953	0.19				
09:20:00 AM	11.03	1013	0.18				
09:21:00 AM	11.02	1073	0.17				
09:22:00 AM	11.02	1133	0.17				
09:23:00 AM	11.01	1193	0.16				
09:24:00 AM	11.01	1253	0.16				
09:25:00 AM	11.01	1313	0.16				

Florida Air National Guard Step 2 Site Investigation  
Slug Test Data  
MW 1-1

Slug In

Slug Out

TIME	TRANSDUCER READING (FEET)	ELAPSED TIME (SEC)	WATER LEVEL CHANGE (FEET)	TRANSDUCER READING (FEET)	ELAPSED TIME (SEC)	WATER LEVEL CHANGE (FEET)
10:15:00 AM	12.33			10:38:00 AM	12.34	
10:16:00 AM	12.33			10:38:00 AM	12.34	
10:17:00 AM	12.33			10:40:00 AM	10.6	
10:18:00 AM	12.33			10:40:01 AM	11.3	
10:18:00 AM	12.33			10:40:02 AM	9.62	0 2.72
10:20:00 AM	12.33			10:40:03 AM	10.61	1 1.73
10:20:01 AM	12.76			10:40:04 AM	10.38	2 1.96
10:20:02 AM	13.45			10:40:05 AM	10.56	3 1.78
10:20:03 AM	13.75			10:40:06 AM	10.57	4 1.77
10:20:04 AM	14.19			10:40:07 AM	10.6	5 1.74
10:20:05 AM	13.81			10:40:08 AM	10.62	6 1.72
10:20:06 AM	14.13			10:40:09 AM	10.64	7 1.7
10:20:07 AM	14.25	0	1.92	10:40:10 AM	10.66	8 1.68
10:20:08 AM	14.01	1	1.68	10:40:11 AM	10.67	9 1.67
10:20:09 AM	13.94	2	1.61	10:40:12 AM	10.69	10 1.63
10:20:10 AM	13.91	3	1.58	10:40:13 AM	10.71	11 1.63
10:20:11 AM	13.65	4	1.32	10:40:14 AM	10.73	12 1.61
10:20:12 AM	13.85	5	1.52	10:40:15 AM	10.74	13 1.6
10:20:13 AM	14.15	6	1.82	10:40:16 AM	10.76	14 1.58
10:20:14 AM	13.41	7	1.08	10:40:17 AM	10.78	15 1.56
10:20:15 AM	13.78	8	1.45	10:40:18 AM	10.8	16 1.54
10:20:16 AM	13.15	9	0.82	10:40:19 AM	10.8	17 1.54
10:20:17 AM	13.87	10	1.54	10:40:20 AM	10.82	18 1.52
10:20:18 AM	13.82	11	1.49	10:40:21 AM	10.83	19 1.51
10:20:19 AM	13.76	12	1.43	10:40:22 AM	10.85	20 1.49
10:20:20 AM	13.72	13	1.39	10:40:23 AM	10.86	21 1.48
10:20:21 AM	13.69	14	1.36	10:40:24 AM	10.87	22 1.47
10:20:22 AM	13.68	15	1.35	10:40:25 AM	10.89	23 1.45
10:20:23 AM	13.54	16	1.21	10:40:26 AM	10.9	24 1.44
10:20:24 AM	13.65	17	1.32	10:40:27 AM	10.92	25 1.42
10:20:25 AM	13.63	18	1.3	10:40:28 AM	10.93	26 1.41
10:20:26 AM	13.62	19	1.29	10:40:29 AM	10.94	27 1.4
10:20:27 AM	13.62	20	1.29	10:40:30 AM	10.95	28 1.39
10:20:28 AM	13.6	21	1.27	10:40:31 AM	10.96	29 1.38
10:20:29 AM	13.59	22	1.26	10:40:32 AM	10.98	30 1.36
10:20:30 AM	13.57	23	1.24	10:40:33 AM	10.99	31 1.35
10:20:31 AM	13.56	24	1.23	10:40:34 AM	10.99	32 1.33
10:20:32 AM	13.55	25	1.22	10:40:35 AM	11	33 1.34
10:20:33 AM	13.54	26	1.21	10:40:36 AM	11.02	34 1.32
10:20:34 AM	13.53	27	1.2	10:40:37 AM	11.03	35 1.31
10:20:35 AM	13.53	28	1.2	10:40:38 AM	11.04	36 1.3
10:20:36 AM	13.51	29	1.18	10:40:39 AM	11.05	37 1.29
10:20:37 AM	13.49	30	1.16	10:40:40 AM	11.06	38 1.28
10:20:38 AM	13.48	31	1.15	10:40:41 AM	11.07	39 1.27
10:20:39 AM	13.47	32	1.14	10:40:42 AM	11.08	40 1.26
10:20:40 AM	13.45	33	1.12	10:40:43 AM	11.09	41 1.25
10:20:41 AM	13.44	34	1.11	10:40:44 AM	11.11	42 1.23
10:20:42 AM	13.43	35	1.1	10:40:45 AM	11.11	43 1.23
10:20:43 AM	13.42	36	1.09	10:40:46 AM	11.12	44 1.22
10:20:44 AM	13.41	37	1.08	10:40:47 AM	11.13	45 1.21
10:20:45 AM	13.4	38	1.07	10:40:48 AM	11.14	46 1.2
10:20:46 AM	13.39	39	1.06	10:40:49 AM	11.15	47 1.19
10:20:47 AM	13.38	40	1.05	10:40:50 AM	11.16	48 1.18

10:20:48 AM	13.36	41	1.03	10:40:51 AM	11.17	49	1.17
10:20:49 AM	13.36	42	1.03	10:40:52 AM	11.18	50	1.16
10:20:50 AM	13.35	43	1.02	10:40:53 AM	11.18	51	1.16
10:20:51 AM	13.34	44	1.01	10:40:54 AM	11.19	52	1.15
10:20:52 AM	13.33	45	1	10:40:55 AM	11.2	53	1.14
10:20:53 AM	13.32	46	0.99	10:40:56 AM	11.21	54	1.13
10:20:54 AM	13.31	47	0.98	10:40:57 AM	11.22	55	1.12
10:20:55 AM	13.3	48	0.97	10:40:58 AM	11.23	56	1.11
10:20:56 AM	13.3	49	0.97	10:40:59 AM	11.24	57	1.1
10:20:57 AM	13.29	50	0.96	10:41:00 AM	11.25	58	1.09
10:20:58 AM	13.28	51	0.95	10:41:10 AM	11.32	68	1.02
10:20:59 AM	13.27	52	0.94	10:41:20 AM	11.39	78	0.95
10:21:00 AM	13.26	53	0.93	10:41:30 AM	11.46	88	0.88
10:21:10 AM	13.18	63	0.85	10:41:40 AM	11.52	98	0.82
10:21:20 AM	13.1	73	0.77	10:41:50 AM	11.57	108	0.77
10:21:30 AM	13.04	83	0.71	10:42:00 AM	11.62	118	0.72
10:21:40 AM	12.98	93	0.65	10:42:10 AM	11.66	128	0.68
10:21:50 AM	12.93	103	0.6	10:42:20 AM	11.7	138	0.64
10:22:00 AM	12.89	113	0.56	10:42:30 AM	11.74	148	0.6
10:22:10 AM	12.84	123	0.51	10:42:40 AM	11.77	158	0.57
10:22:20 AM	12.8	133	0.47	10:42:50 AM	11.81	168	0.53
10:22:30 AM	12.77	143	0.44	10:43:00 AM	11.83	178	0.51
10:22:40 AM	12.73	153	0.4	10:43:10 AM	11.86	188	0.48
10:22:50 AM	12.71	163	0.38	10:43:20 AM	11.89	198	0.45
10:23:00 AM	12.68	173	0.35	10:43:30 AM	11.9	208	0.44
10:23:10 AM	12.65	183	0.32	10:43:40 AM	11.93	218	0.41
10:23:20 AM	12.63	193	0.3	10:43:50 AM	11.95	228	0.39
10:23:30 AM	12.6	203	0.27	10:44:00 AM	11.96	238	0.38
10:23:40 AM	12.59	213	0.26	10:44:10 AM	11.98	248	0.36
10:23:50 AM	12.57	223	0.24	10:44:20 AM	12	258	0.34
10:24:00 AM	12.55	233	0.22	10:44:30 AM	12.01	268	0.33
10:24:10 AM	12.53	243	0.2	10:44:40 AM	12.02	278	0.32
10:24:20 AM	12.53	253	0.2	10:44:50 AM	12.03	288	0.31
10:24:30 AM	12.51	263	0.18	10:46:00 AM	12.1	358	0.24
10:24:40 AM	12.5	273	0.17	10:47:00 AM	12.14	418	0.2
10:24:50 AM	12.49	283	0.16	10:48:00 AM	12.15	478	0.19
10:26:00 AM	12.44	333	0.11	10:49:00 AM	12.17	538	0.17
10:27:00 AM	12.4	413	0.07	10:50:00 AM	12.19	598	0.15
10:28:00 AM	12.39	473	0.06				
10:29:00 AM	12.37	533	0.04				
10:30:00 AM	12.36	593	0.03				
10:31:00 AM	12.35	653	0.02				
10:32:00 AM	12.35	713	0.02				
10:33:00 AM	12.34	773	0.01				
10:34:00 AM	12.34	833	0.01				
10:35:00 AM	12.34	893	0.01				
10:36:00 AM	12.34	953	0.01				
10:37:00 AM	12.34	1013	0.01				

Florida Air National Guard Step 2 Site Investigation  
Slug Test Data  
MW 5-2

Slug In

Slug Out

TIME	TRANSDUCER READING (FEET)	ELAPSED WATER LEVEL		TRANSDUCER READING (FEET)	ELAPSED WATER LEVEL	
		TIME (SEC)	CHANGE (FEET)		TIME (SEC)	CHANGE (FEET)
12:42:00 PM	10.09			12:53:00 PM	10.31	
02:43:00 AM	10.28			12:53:00 PM	10.31	
02:44:00 AM	10.28			12:55:00 PM	10.3	
02:44:00 AM	10.28			12:55:01 PM	10.3	
02:46:00 AM	10.28			12:55:02 PM	8.9	
02:46:01 AM	10.72			12:55:03 PM	8.94	
02:46:02 AM	11.32			12:55:04 PM	8.46	
02:46:03 AM	11.43			12:55:05 PM	8.42	
12:46:04 PM	11.29			12:55:06 PM	8.41	0 1.9
12:46:05 PM	11.22			12:55:07 PM	8.53	1 1.78
12:46:06 PM	11.04			12:55:08 PM	8.58	2 1.73
12:46:07 PM	11.28			12:55:09 PM	8.62	3 1.69
12:46:08 PM	11.33			12:55:10 PM	8.66	4 1.65
12:46:09 PM	11.39			12:55:11 PM	8.69	5 1.62
12:46:10 PM	11.76			12:55:12 PM	8.73	6 1.58
12:46:11 PM	11.79			12:55:13 PM	8.76	7 1.55
12:46:12 PM	11.82	0	1.54	12:55:14 PM	8.8	8 1.51
12:46:13 PM	11.7	1	1.42	12:55:15 PM	8.83	9 1.48
12:46:14 PM	11.71	2	1.43	12:55:16 PM	8.86	10 1.43
12:46:15 PM	11.55	3	1.27	12:55:17 PM	8.89	11 1.42
12:46:16 PM	11.39	4	1.31	12:55:18 PM	8.92	12 1.39
12:46:17 PM	11.33	5	1.05	12:55:19 PM	8.94	13 1.37
12:46:18 PM	11.43	6	1.15	12:55:20 PM	8.97	14 1.34
12:46:19 PM	11.42	7	1.14	12:55:21 PM	9	15 1.31
12:46:20 PM	11.45	8	1.17	12:55:22 PM	9.03	16 1.28
12:46:21 PM	11.35	9	1.07	12:55:23 PM	9.06	17 1.25
12:46:22 PM	11.34	10	1.06	12:55:24 PM	9.08	18 1.23
12:46:23 PM	11.3	11	1.02	12:55:25 PM	9.1	19 1.21
12:46:24 PM	11.27	12	0.99	12:55:26 PM	9.13	20 1.18
12:46:25 PM	11.25	13	0.97	12:55:27 PM	9.15	21 1.16
12:46:26 PM	11.24	14	0.96	12:55:28 PM	9.18	22 1.13
12:46:27 PM	11.22	15	0.94	12:55:29 PM	9.2	23 1.11
12:46:28 PM	11.19	16	0.91	12:55:30 PM	9.22	24 1.09
12:46:29 PM	11.18	17	0.9	12:55:31 PM	9.24	25 1.07
12:46:30 PM	11.16	18	0.88	12:55:32 PM	9.26	26 1.05
12:46:31 PM	11.14	19	0.86	12:55:33 PM	9.28	27 1.03
12:46:32 PM	11.12	20	0.84	12:55:34 PM	9.3	28 1.01
12:46:33 PM	11.23	21	0.95	12:55:35 PM	9.32	29 0.99
12:46:34 PM	11.08	22	0.8	12:55:36 PM	9.34	30 0.97
12:46:35 PM	11.02	23	0.74	12:55:37 PM	9.36	31 0.95
12:46:36 PM	11.09	24	0.81	12:55:38 PM	9.38	32 0.93
12:46:37 PM	10.98	25	0.7	12:55:39 PM	9.39	33 0.92
12:46:38 PM	11.18	26	0.9	12:55:40 PM	9.41	34 0.9
12:46:39 PM	10.99	27	0.71	12:55:41 PM	9.43	35 0.88
12:46:40 PM	11.08	28	0.8	12:55:42 PM	9.45	36 0.86
12:46:41 PM	11.17	29	0.89	12:55:43 PM	9.46	37 0.85
12:46:42 PM	10.98	30	0.7	12:55:44 PM	9.48	38 0.83
12:46:43 PM	10.96	31	0.68	12:55:45 PM	9.5	39 0.81
12:46:44 PM	10.96	32	0.68	12:55:46 PM	9.52	40 0.79
12:46:45 PM	10.95	33	0.67	12:55:47 PM	9.53	41 0.78
12:46:46 PM	10.93	34	0.65	12:55:48 PM	9.54	42 0.77
12:46:47 PM	10.99	35	0.71	12:55:49 PM	9.56	43 0.75
12:46:48 PM	10.91	36	0.63	12:55:50 PM	9.58	44 0.73

12:46:49 PM	10.89	37	0.61	12:55:51 PM	9.58	45	0.73
12:46:50 PM	10.8	38	0.52	12:55:52 PM	9.6	46	0.71
12:46:51 PM	10.88	39	0.6	12:55:53 PM	9.62	47	0.69
12:46:52 PM	10.87	40	0.59	12:55:54 PM	9.63	48	0.68
12:46:53 PM	10.86	41	0.58	12:55:55 PM	9.64	49	0.67
12:46:54 PM	10.92	42	0.64	12:55:56 PM	9.65	50	0.66
12:46:55 PM	10.75	43	0.47	12:55:57 PM	9.66	51	0.65
12:46:56 PM	10.68	44	0.4	12:55:58 PM	9.68	52	0.63
12:46:57 PM	10.83	45	0.55	12:55:59 PM	9.69	53	0.62
12:46:58 PM	10.91	46	0.53	12:56:00 PM	9.7	54	0.61
12:46:59 PM	10.8	47	0.52	12:56:10 PM	9.81	64	0.5
12:47:00 PM	10.8	48	0.52	12:56:20 PM	9.9	74	0.41
12:47:10 PM	10.71	58	0.43	12:56:30 PM	9.96	84	0.35
12:47:20 PM	10.67	68	0.39	12:56:40 PM	10.02	94	0.29
12:47:30 PM	10.61	78	0.33	12:56:50 PM	10.07	104	0.24
12:47:40 PM	10.55	88	0.27	12:57:00 PM	10.1	114	0.21
12:47:50 PM	10.51	98	0.23	12:57:10 PM	10.16	124	0.15
12:48:00 PM	10.48	108	0.2	12:57:20 PM	10.18	134	0.13
12:48:10 PM	10.45	118	0.17	12:57:30 PM	10.21	144	0.1
12:48:20 PM	10.43	128	0.15	12:57:40 PM	10.22	154	0.09
12:48:30 PM	10.41	138	0.13	12:57:50 PM	10.23	164	0.08
12:48:40 PM	10.4	148	0.12	12:58:00 PM	10.24	174	0.07
12:48:50 PM	10.38	158	0.1	12:58:10 PM	10.25	184	0.06
12:49:00 PM	10.37	168	0.09	12:58:20 PM	10.26	194	0.05
12:49:10 PM	10.36	178	0.08	12:58:30 PM	10.27	204	0.04
12:49:20 PM	10.35	188	0.07	12:58:40 PM	10.28	214	0.03
12:49:30 PM	10.35	198	0.07	12:58:50 PM	10.28	224	0.03
12:49:40 PM	10.34	208	0.06	12:59:00 PM	10.28	234	0.03
12:49:50 PM	10.34	218	0.06	12:59:10 PM	10.28	244	0.03
12:50:00 PM	10.33	228	0.05	12:59:20 PM	10.29	254	0.02
12:50:10 PM	10.33	238	0.05	12:59:30 PM	10.29	264	0.02
12:50:20 PM	10.32	248	0.04	12:59:40 PM	10.29	274	0.02
12:50:30 PM	10.32	258	0.04	12:59:50 PM	10.29	284	0.02
12:50:40 PM	10.32	268	0.04				
12:50:50 PM	10.32	278	0.04				
12:52:00 PM	10.31	348	0.03				

Florida Air National Guard Step 2 Site Investigation  
Slug Test Data  
MW 6-1

Slug In

Slug Out

TIME	TRANSDUCER READING (FEET)	ELAPSED TIME (SEC)	WATER LEVEL CHANGE (FEET)	TRANSDUCER READING (FEET)	ELAPSED TIME (SEC)	WATER LEVEL CHANGE (FEET)
11:40:00 AM	9.15			11:52:00 AM	9.18	
01:41:00 AM	9.15			11:53:00 AM	9.18	
01:42:00 AM	9.17			11:53:00 AM	9.18	
01:43:00 AM	9.15			11:55:00 AM	8.69	
01:43:00 AM	9.15			11:55:01 AM	7.82	
01:45:00 AM	9.82			11:55:02 AM	7.5	0 1.68
01:45:01 AM	9.84			11:55:03 AM	7.66	1 1.52
01:45:02 AM	9.68			11:55:04 AM	7.76	2 1.42
01:45:03 AM	9.72			11:55:05 AM	7.89	3 1.29
01:45:04 AM	9.61			11:55:06 AM	7.96	4 1.22
11:45:05 AM	9.55			11:55:07 AM	8.04	5 1.14
11:45:06 AM	9.53			11:55:08 AM	8.12	6 1.06
11:45:07 AM	9.51			11:55:09 AM	8.19	7 0.99
11:45:08 AM	9.44			11:55:10 AM	8.25	8 0.93
11:45:09 AM	9.32			11:55:11 AM	8.31	9 0.87
11:45:10 AM	9.82			11:55:12 AM	8.37	10 0.81
11:45:11 AM	10.22			11:55:13 AM	8.43	11 0.75
11:45:12 AM	10.48	0	1.33	11:55:14 AM	8.47	12 0.71
11:45:13 AM	10.45	1	1.3	11:55:15 AM	8.51	13 0.67
11:45:14 AM	9.75	2	0.6	11:55:16 AM	8.55	14 0.63
11:45:15 AM	9.91	3	0.76	11:55:17 AM	8.59	15 0.59
11:45:16 AM	9.63	4	0.48	11:55:18 AM	8.62	16 0.56
11:45:17 AM	9.83	5	0.68	11:55:19 AM	8.66	17 0.52
11:45:18 AM	9.84	6	0.69	11:55:20 AM	8.69	18 0.49
11:45:19 AM	9.75	7	0.6	11:55:21 AM	8.72	19 0.46
11:45:20 AM	9.84	8	0.69	11:55:22 AM	8.75	20 0.43
11:45:21 AM	9.76	9	0.61	11:55:23 AM	8.77	21 0.41
11:45:22 AM	9.71	10	0.56	11:55:24 AM	8.79	22 0.39
11:45:23 AM	9.66	11	0.51	11:55:25 AM	8.81	23 0.37
11:45:24 AM	9.71	12	0.56	11:55:26 AM	8.83	24 0.35
11:45:25 AM	9.57	13	0.42	11:55:27 AM	8.85	25 0.33
11:45:26 AM	9.47	14	0.32	11:55:28 AM	8.88	26 0.3
11:45:27 AM	9.57	15	0.42	11:55:29 AM	8.88	27 0.3
11:45:28 AM	9.55	16	0.4	11:55:30 AM	8.9	28 0.28
11:45:29 AM	9.52	17	0.37	11:55:31 AM	8.92	29 0.26
11:45:30 AM	9.51	18	0.36	11:55:32 AM	8.93	30 0.25
11:45:31 AM	9.49	19	0.34	11:55:33 AM	8.94	31 0.24
11:45:32 AM	9.47	20	0.32	11:55:34 AM	8.95	32 0.23
11:45:33 AM	9.45	21	0.3	11:55:35 AM	8.96	33 0.22
11:45:34 AM	9.44	22	0.29	11:55:36 AM	8.97	34 0.21
11:45:35 AM	9.42	23	0.27	11:55:37 AM	8.99	35 0.19
11:45:36 AM	9.4	24	0.25	11:55:38 AM	9	36 0.18
11:45:37 AM	9.46	25	0.31	11:55:39 AM	9	37 0.18
11:45:38 AM	9.35	26	0.2	11:55:40 AM	9	38 0.18
11:45:39 AM	9.39	27	0.24	11:55:41 AM	9.01	39 0.17
11:45:40 AM	9.52	28	0.37	11:55:42 AM	9.02	40 0.16
11:45:41 AM	9.35	29	0.2	11:55:43 AM	9.03	41 0.15
11:45:42 AM	9.38	30	0.23	11:55:44 AM	9.03	42 0.15
11:45:43 AM	9.4	31	0.25	11:55:45 AM	9.04	43 0.14
11:45:44 AM	9.34	32	0.19	11:55:46 AM	9.05	44 0.13
11:45:45 AM	9.32	33	0.17	11:55:47 AM	9.05	45 0.13
11:45:46 AM	9.32	34	0.17	11:55:48 AM	9.06	46 0.12
11:45:47 AM	9.36	35	0.21	11:55:49 AM	9.06	47 0.12

11:45:48 AM	9.32	36	0.17	11:55:50 AM	9.07	48	0.11
11:45:49 AM	9.19	37	0.04	11:55:51 AM	9.07	49	0.11
11:45:50 AM	9.62	38	0.47	11:55:52 AM	9.07	50	0.11
11:45:51 AM	9.46	39	0.31	11:55:53 AM	9.07	51	0.11
11:45:52 AM	9.24	40	0.09	11:55:54 AM	9.08	52	0.1
11:45:53 AM	9.1	41	-0.05	11:55:55 AM	9.08	53	0.1
11:45:54 AM	9.5	42	0.35	11:55:56 AM	9.09	54	0.09
11:45:55 AM	9.3	43	0.15	11:55:57 AM	9.09	55	0.09
11:45:56 AM	9.28	44	0.13	11:55:58 AM	9.09	56	0.09
11:45:57 AM	9.28	45	0.13	11:55:59 AM	9.09	57	0.09
11:45:58 AM	9.27	46	0.12	11:56:00 AM	9.1	58	0.08
11:45:59 AM	9.26	47	0.11	11:56:10 AM	9.12	68	0.06
11:46:00 AM	9.26	48	0.11	11:56:20 AM	9.13	78	0.05
11:46:10 AM	9.23	58	0.08	11:56:30 AM	9.13	88	0.05
11:46:20 AM	9.2	68	0.05	11:56:40 AM	9.13	98	0.05
11:46:30 AM	9.2	78	0.05	11:56:50 AM	9.14	108	0.04
11:46:40 AM	9.19	88	0.04	11:57:00 AM	9.14	118	0.04
11:46:50 AM	9.19	98	0.04	11:57:10 AM	9.14	128	0.04
11:47:00 AM	9.19	108	0.04	11:57:20 AM	9.14	138	0.04
11:47:10 AM	9.18	118	0.03	11:57:30 AM	9.14	148	0.04
11:47:20 AM	9.18	128	0.03	11:57:40 AM	9.14	158	0.04
11:47:30 AM	9.18	138	0.03	11:57:50 AM	9.15	168	0.03
11:47:40 AM	9.18	148	0.03	11:58:00 AM	9.15	178	0.03
11:47:50 AM	9.18	158	0.03	11:58:10 AM	9.15	188	0.03
11:48:00 AM	9.18	168	0.03	11:58:20 AM	9.15	198	0.03
11:48:10 AM	9.18	178	0.03	11:58:30 AM	9.15	208	0.03
11:48:20 AM	9.18	188	0.03	11:58:40 AM	9.15	218	0.03
11:48:30 AM	9.18	198	0.03	11:58:50 AM	9.15	228	0.03
11:48:40 AM	9.18	208	0.03	11:59:00 AM	9.15	238	0.03
11:48:50 AM	9.18	218	0.03	11:59:10 AM	9.15	248	0.03
11:49:00 AM	9.18	228	0.03	11:59:20 AM	9.15	258	0.03
11:49:10 AM	9.18	238	0.03	11:59:30 AM	9.15	268	0.03
11:49:20 AM	9.18	248	0.03	11:59:40 AM	9.15	278	0.03
11:49:30 AM	9.18	258	0.03	11:59:50 AM	9.15	288	0.03
11:49:40 AM	9.18	268	0.03				
11:49:50 AM	9.18	278	0.03				
11:51:00 AM	9.18	348	0.03				

Florida Air National Guard Step 2 Site Investigation  
Slug Test Data  
MW 8-1

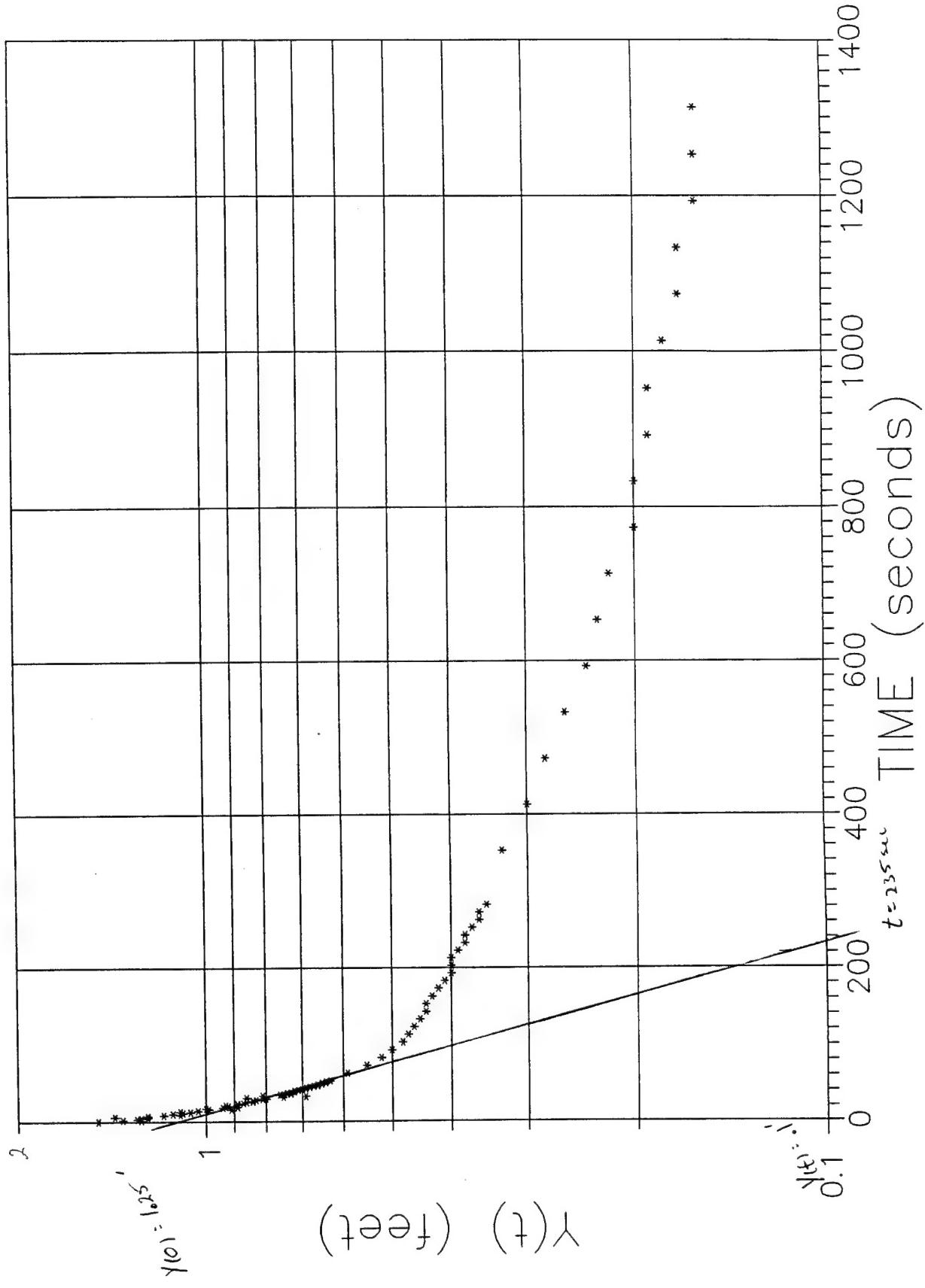
Slug In

Slug Out

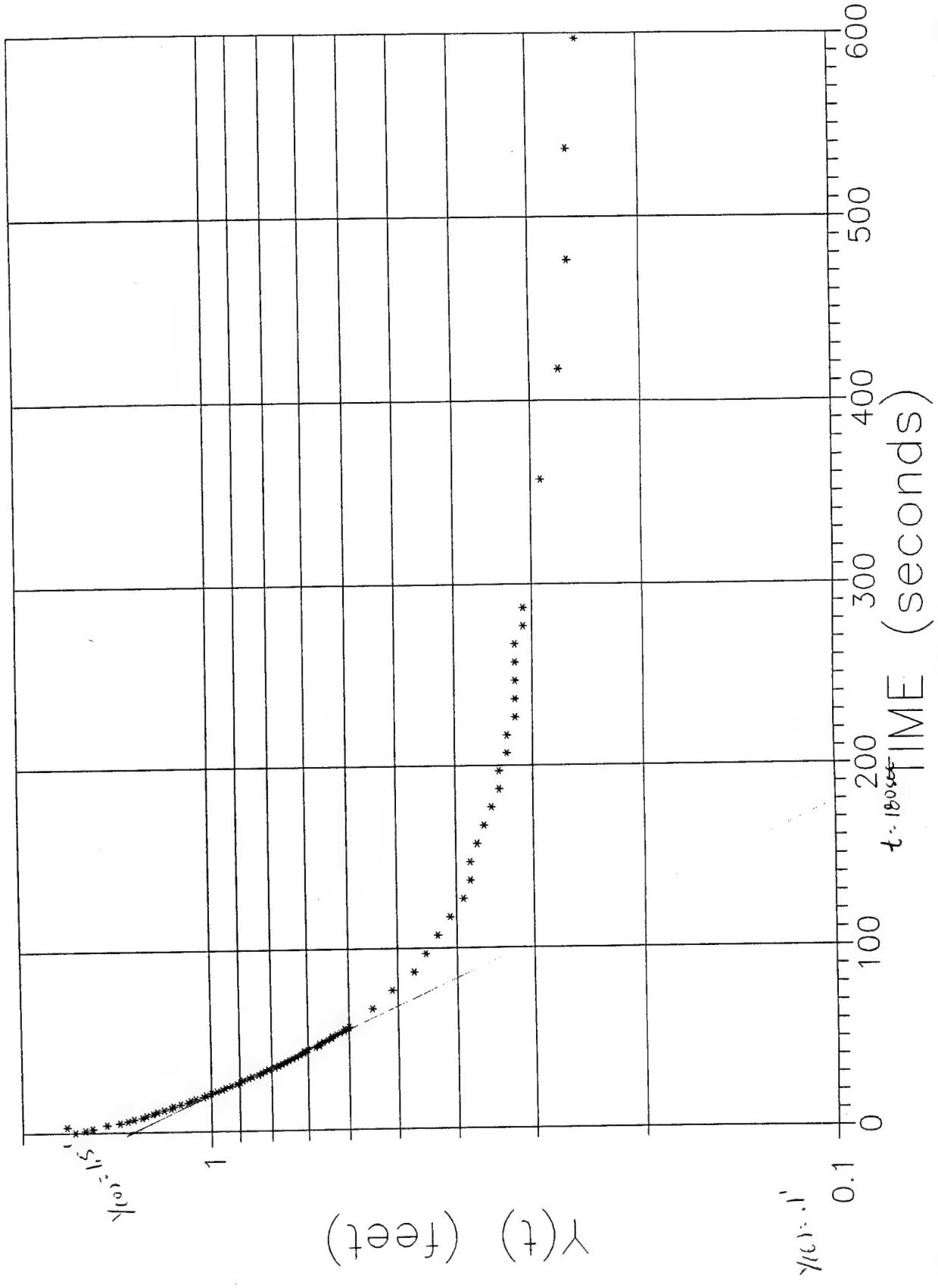
TRANSDUCER READING TIME (FEET)		ELAPSED TIME (SEC)	WATER LEVEL CHANGE (FEET)	TRANSDUCER READING TIME (FEET)		ELAPSED TIME (SEC)	WATER LEVEL CHANGE (FEET)
01:15:00 PM	12.86			01:22:00 PM	12.87		
01:16:00 PM	13.33			01:23:00 PM	12.87		
01:17:00 PM	13.19			01:23:00 PM	12.87		
01:18:00 PM	13			01:25:00 PM	12.87		
01:19:00 PM	12.91			01:25:01 PM	12.4		
01:20:00 PM	12.89			01:25:02 PM	11.51		
01:21:00 PM	12.88			01:25:03 PM	10.24	0	2.63
<b>Note : Slug in test not performed because water level was too close to the top of casing and water overtopped casing during the insertion of the slug into the well.</b>				01:25:04 PM	10.85	1	2.02
				01:25:05 PM	10.92	2	1.95
				01:25:06 PM	10.98	3	1.89
				01:25:07 PM	11.04	4	1.83
				01:25:08 PM	11.09	5	1.78
				01:25:09 PM	11.14	6	1.73
				01:25:10 PM	11.18	7	1.69
				01:25:11 PM	11.24	8	1.63
				01:25:12 PM	11.28	9	1.59
				01:25:13 PM	11.32	10	1.55
				01:25:14 PM	11.36	11	1.51
				01:25:15 PM	11.4	12	1.47
				01:25:16 PM	11.44	13	1.43
				01:25:17 PM	11.48	14	1.39
				01:25:18 PM	11.51	15	1.36
				01:25:19 PM	11.55	16	1.32
				01:25:20 PM	11.57	17	1.3
				01:25:21 PM	11.61	18	1.26
				01:25:22 PM	11.64	19	1.23
				01:25:23 PM	11.67	20	1.2
				01:25:24 PM	11.69	21	1.18
				01:25:25 PM	11.73	22	1.14
				01:25:26 PM	11.76	23	1.11
				01:25:27 PM	11.78	24	1.09
				01:25:28 PM	11.81	25	1.06
				01:25:29 PM	11.83	26	1.04
				01:25:30 PM	11.86	27	1.01
				01:25:31 PM	11.88	28	0.99
				01:25:32 PM	11.9	29	0.97
				01:25:33 PM	11.93	30	0.94
				01:25:34 PM	11.95	31	0.92
				01:25:35 PM	11.97	32	0.9
				01:25:36 PM	11.99	33	0.88
				01:25:37 PM	12.01	34	0.86
				01:25:38 PM	12.03	35	0.84
				01:25:39 PM	12.05	36	0.82
				01:25:40 PM	12.07	37	0.8
				01:25:41 PM	12.08	38	0.79
				01:25:42 PM	12.1	39	0.77
				01:25:43 PM	12.12	40	0.75
				01:25:44 PM	12.14	41	0.73
				01:25:45 PM	12.15	42	0.72
				01:25:46 PM	12.16	43	0.71
				01:25:47 PM	12.18	44	0.69
				01:25:48 PM	12.2	45	0.67
				01:25:49 PM	12.21	46	0.66

01:25:50 PM	12.22	47	0.65
01:25:51 PM	12.24	48	0.63
01:25:52 PM	12.25	49	0.62
01:25:53 PM	12.27	50	0.6
01:25:54 PM	12.27	51	0.6
01:25:55 PM	12.29	52	0.58
01:25:56 PM	12.3	53	0.57
01:25:57 PM	12.31	54	0.56
01:25:58 PM	12.33	55	0.54
01:25:59 PM	12.34	56	0.53
01:26:00 PM	12.34	57	0.53
01:26:10 PM	12.44	67	0.43
01:26:20 PM	12.52	77	0.35
01:26:30 PM	12.58	87	0.29
01:26:40 PM	12.62	97	0.25
01:26:50 PM	12.66	107	0.21
01:27:00 PM	12.7	117	0.17
01:27:10 PM	12.72	127	0.15
01:27:20 PM	12.74	137	0.13
01:27:30 PM	12.76	147	0.11
01:27:40 PM	12.77	157	0.1
01:27:50 PM	12.78	167	0.09
01:28:00 PM	12.79	177	0.08
01:28:10 PM	12.8	187	0.07
01:28:20 PM	12.8	197	0.07
01:28:30 PM	12.81	207	0.06
01:28:40 PM	12.82	217	0.05
01:28:50 PM	12.82	227	0.05
01:29:00 PM	12.82	237	0.05
01:29:10 PM	12.83	247	0.04
01:29:20 PM	12.84	257	0.03
01:29:30 PM	12.83	267	0.04
01:29:40 PM	12.84	277	0.03
01:29:50 PM	12.84	287	0.03
01:30:00 PM	12.85	297	0.02

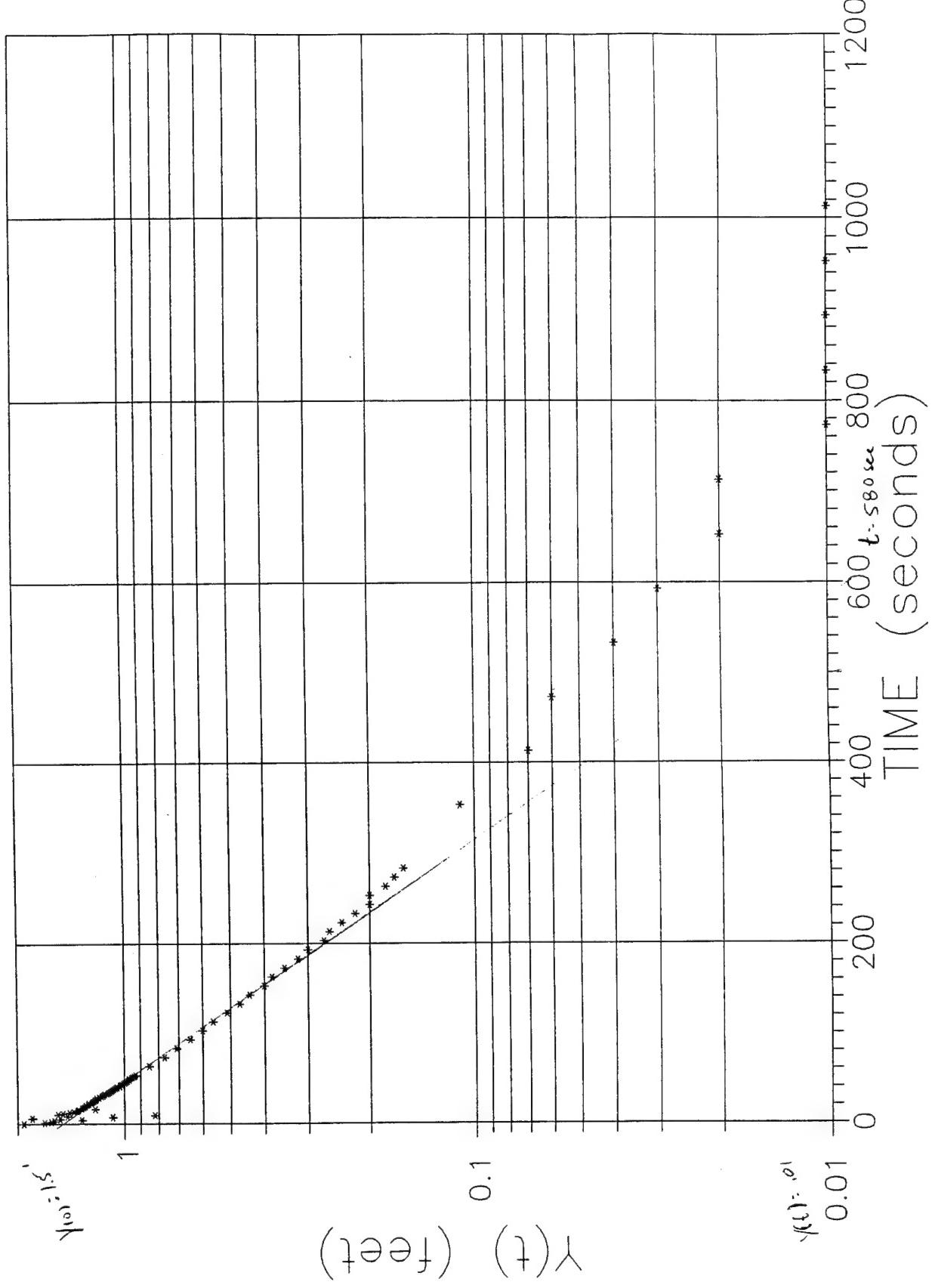
MW 3E-2 Slug In Test



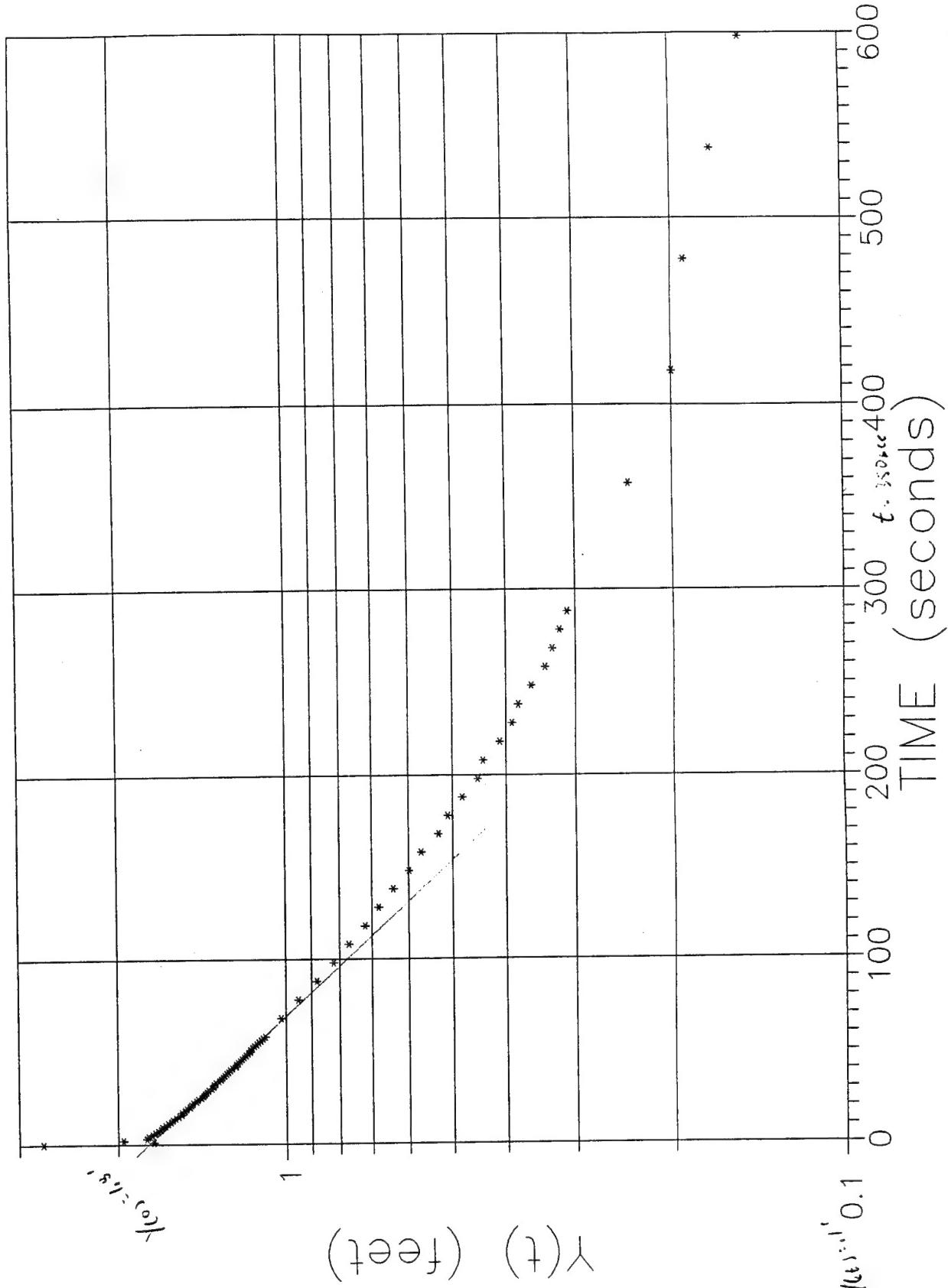
MW 3E-2 Slug Out Test



MW 1-1 Slug In Test

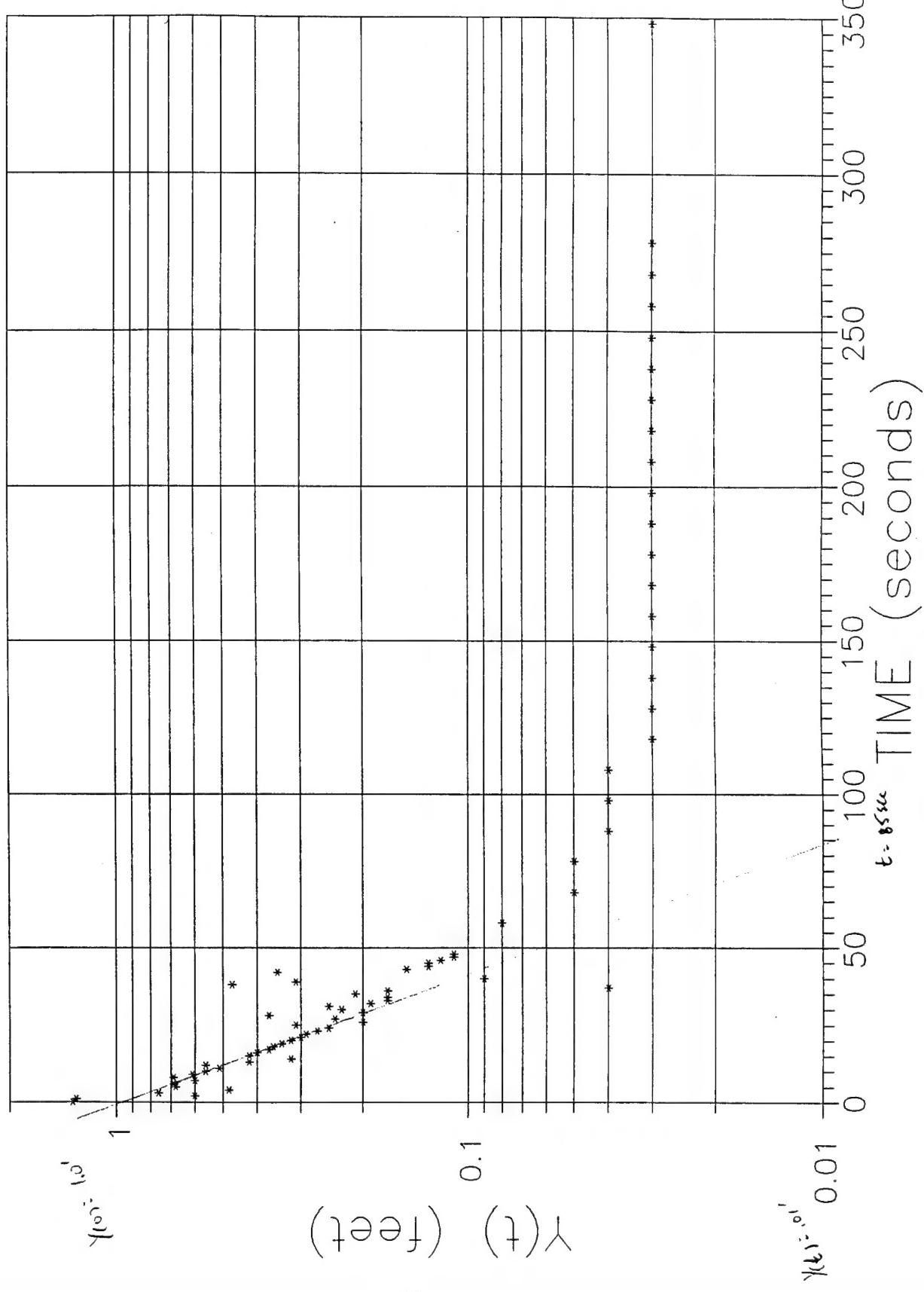


MW 1-1 Slug Out Test

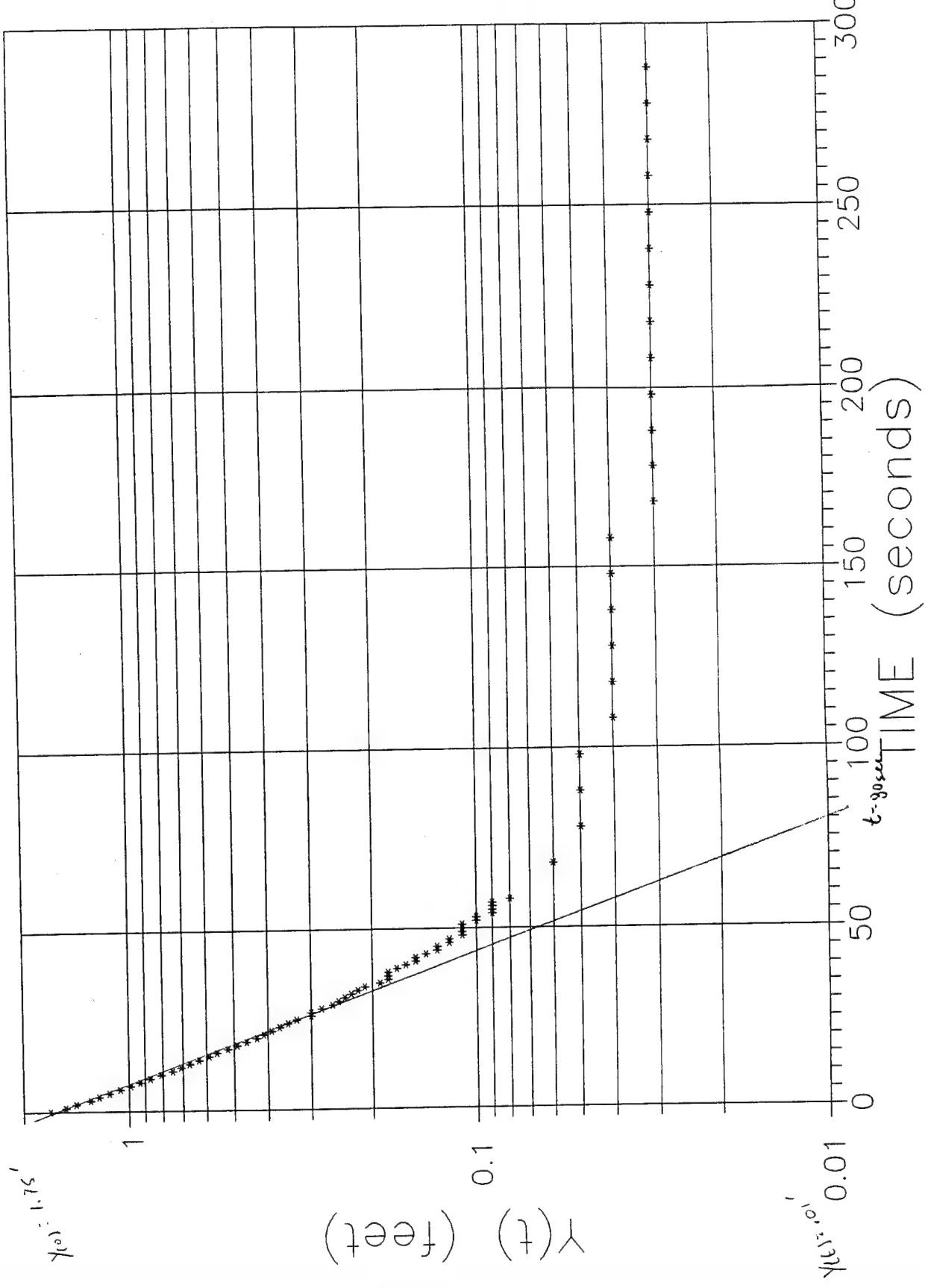


D-14

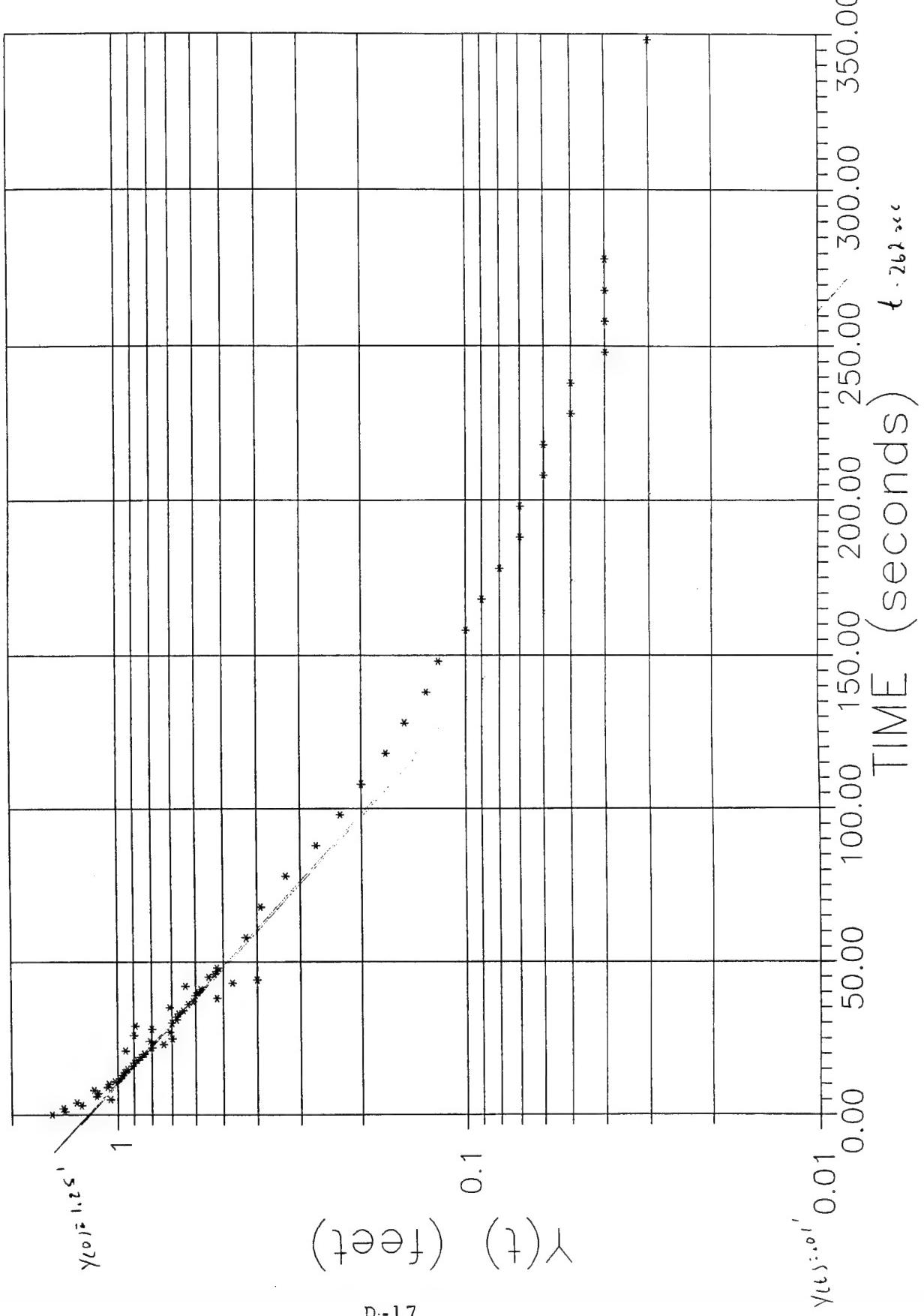
MW 6-1 Slug In Test



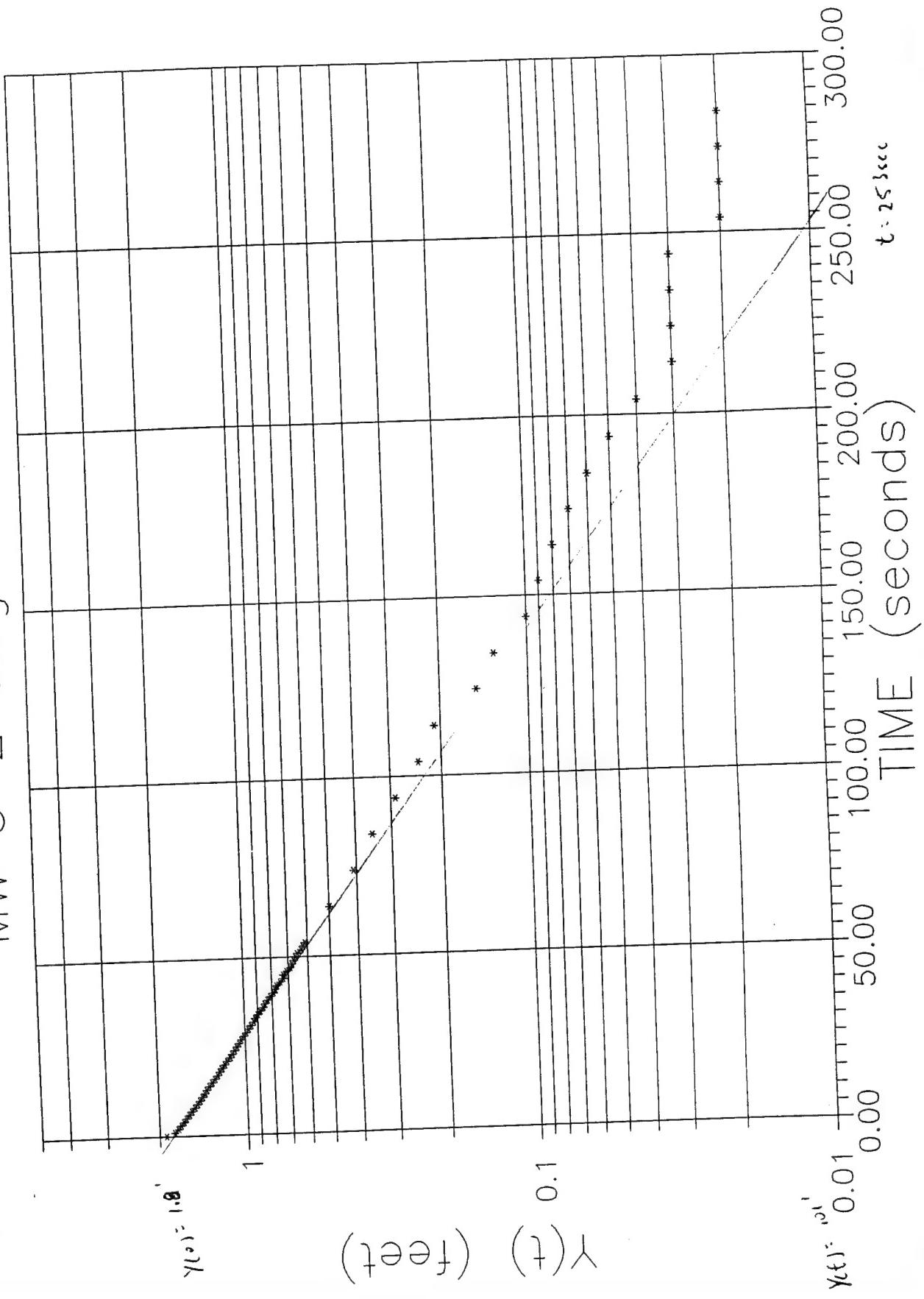
MW 6-1 Slug Out Test



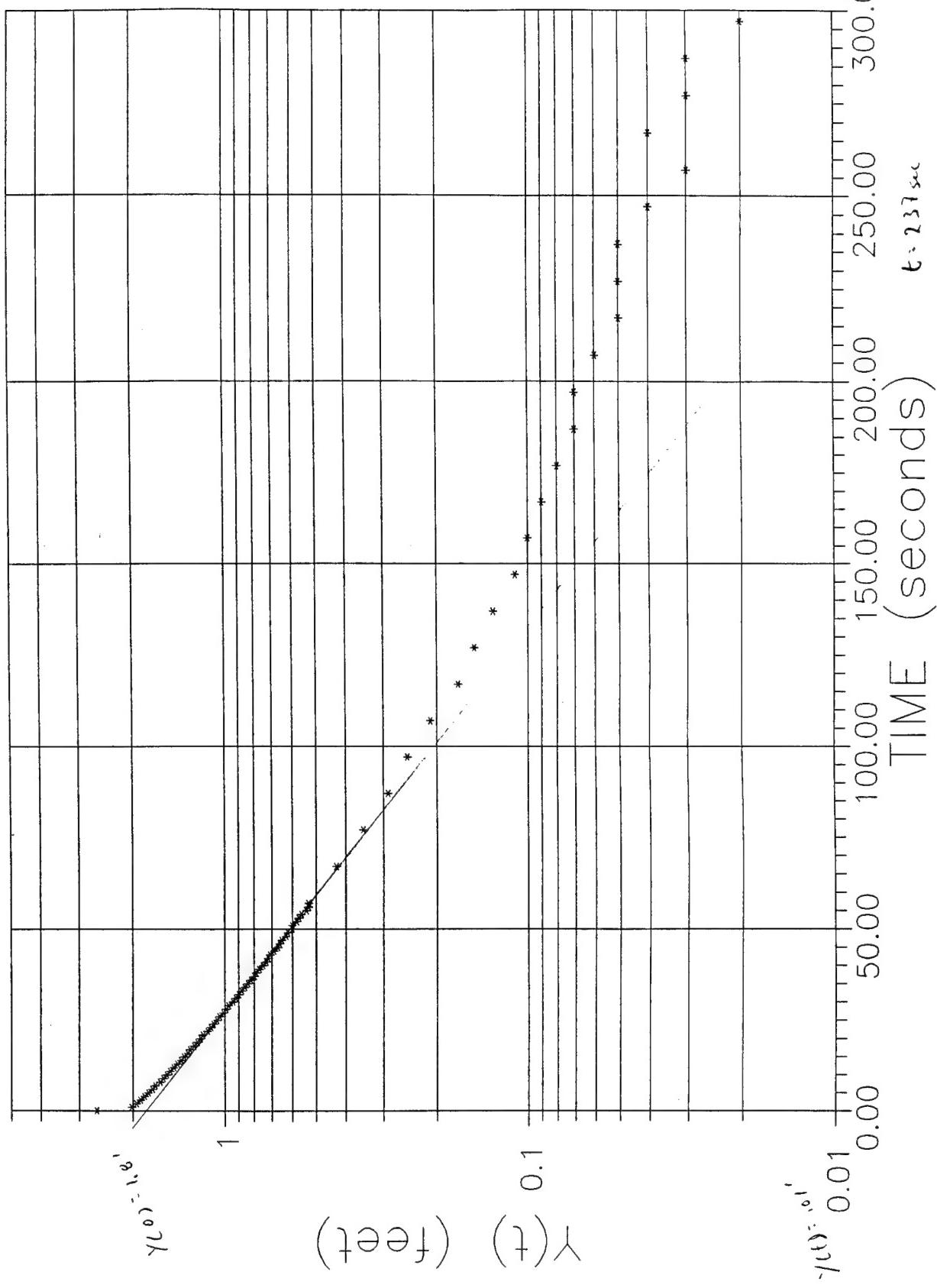
MW 5-2 Slug In Test



MW 5-2 Slug Out Test



MW 8-1 Slug Out Test



FANG SLUG TEST ANALYSES  
FULL PENETRATION ASSUMED

BNV27267.JX.RI

WELL #	COMPUTED WELL								\$APPROX.		
	WELL RADIUS Rc,(FT)	DEPTH BLS (FT)	DTW FROM SURFACE (FT)	DEPTH BELOW WATER Lw,(FT)	SCREEN LENGTH Le,(FT)	BORHOLE RADIUS Rw,(FT)	SAT. THICK. H,(FT)	LN LN/Rw	COMPUTED COEF. C	COMPUTED LN(Re/Rw)	
3E-2	0.0833	15	3.77	11.23	10	0.167	11.23	4.21	60.00	3	3.213
1-1	0.0833	15	2.07	12.93	10	0.167	12.93	4.35	60.00	3	3.303
6-1	0.0833	15	3.57	11.43	10	0.167	11.43	4.23	60.00	3	3.224
5-2	0.0833	15	2.95	12.05	10	0.167	12.05	4.28	60.00	3	3.258
8-1	0.0833	15	0.34	14.66	10	0.167	14.66	4.48	60.00	3	3.382

WELL #	SELECTED Y(T) @				HYD.		HYD.	
	SLUG IN	SLUG OUT	TIME T (SEC)	TIME T (FT)	Y(0)	COND., K (FT/SEC)	COND., K (FT/DAY)	
3E-2	X		235	0.10	1.25	1.20E-05		1.04
3E-2		X	180	0.10	1.5	1.68E-05		1.45
1-1	X		580	0.01	1.5	9.91E-06		0.86
1-1		X	350	0.10	1.8	9.47E-06		0.82
6-1	X		85	0.01	1	6.06E-05		5.24
6-1		X	80	0.01	1.75	7.23E-05		6.24
5-2	X		262	0.01	1.25	2.08E-05		1.80
5-2		X	253	0.01	1.8	2.32E-05		2.01
8-1	X							
B-1		X	237	0.01	1.8	2.57E-05		2.22

FANG SLUG TEST ANALYSES  
PARTIAL PENETRATION ASSUMED

GNV27267.JX.RI

WELL #	COMPUTED										COEF. A	COEF. B	COMPUTED LN(Re/Rw)			
	WELL		DTW	DEPTH		APPROX.			LN							
	RADIUS Rc,(FT)	DEPTH BLs (FT)	FROM SURFACE (FT)	BELOW WATER Lw,(FT)	SCREEN Le,(FT)	BORHOLE Radius Rw,(FT)	THICK. H,(FT)	SAT.								
3E-2	0.0833	15	3.77	11.23	10	0.167	INFINITE		4.21	60.00	3.25	0.55	2.700			
1-1	0.0833	15	2.07	12.93	10	0.167	INFINITE		4.35	60.00	3.25	0.55	2.763			
6-1	0.0833	15	3.57	11.43	10	0.167	INFINITE		4.23	60.00	3.25	0.55	2.708			
5-2	0.0833	15	2.95	12.05	10	0.167	INFINITE		4.28	60.00	3.25	0.55	2.731			
8-1	0.0833	15	0.34	14.66	10	0.167	INFINITE		4.48	60.00	3.25	0.55	2.818			

WELL #	SELECTED Y(T) @					HYD.		HYD. (FT/DAY)
	SLUG IN	SLUG OUT	TIME T (SEC)	TIME T (FT)	Y(0)	COND., K (FT/SEC)		
3E-2	X		235	0.10	1.25	1.01E-05		0.87
3E-2		X	180	0.10	1.5	1.41E-05		1.22
1-1	X		580	0.01	1.5	8.29E-06		0.72
1-1		X	350	0.10	1.8	7.92E-06		0.68
6-1	X		85	0.01	1	5.09E-05		4.40
6-1		X	80	0.01	1.75	6.07E-05		5.24
5-2	X		262	0.01	1.25	1.75E-05		1.51
5-2		X	253	0.01	1.8	1.95E-05		1.68
8-1	X		237	0.01	1.8	2.14E-05		1.85

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**APPENDIX E**  
*Data Validation Technical Memorandum  
for the First Step of the Site Investigation*

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## **FOREWORD**

Data for the first step of the site investigation were validated by CH2M HILL personnel (Chris Ohland and Ann Castleberry) who are not employed by CH2M HILL Environmental Laboratories, Inc. The following technical memorandum describes site investigation data, its quality, and its usability.

MEMORANDUM

CH2M HILL

TO: Becky Svatos/GNV  
FROM: Chris Ohland/GLO  
Ann Castleberry/MGM  
DATE: August 21, 1989  
SUBJECT: Data Validation for Jacksonville ANG  
PROJECT: GNV27267.JX.SI

1.0 INTRODUCTION

This Technical Memorandum presents the data validation discussion and summary tables for the first step of the Jacksonville Air National Guard (ANG) Site Investigation (SI) laboratory data. Data validation is the technical review of a data package using criteria established in the Data Quality Objectives.

The samples from the first step of the SI were analyzed for semivolatiles by gas chromatography/ mass spectrophotometer (GC/MS), volatiles by GC/MS, volatile halocarbons by gas chromatography (GC), volatile aromatics by GC, polychlorinated biphenyls (PCB) by GC/MS, ethylene dibromide (EDB) by GC and GC/MS, polynuclear aromatic hydrocarbons (PAH) by GC/MS, total organic carbon (TOC), total suspended solids (TSS), and metals. Participating laboratories were required to submit the Hazardous Waste Remedial Action Program (HAZWRAP) Level C quality control (QC) data packages for data generated for the SI. Level C QC has established data set deliverables analogous to the Contract Laboratory Program (CLP) deliverables. CLP was developed to standardize the laboratory methods and data package deliverables used for remedial investigations, Superfund work, etc.

Data were reviewed and validated using HAZWRAP Level C Data Validation Guidelines. For methods not listed in HAZWRAP, a similar procedure, which outlines samples holding times, initial calibration, continuing calibration, matrix spike, blank spike, and blank versus sample results was reviewed. In addition, the EPA Laboratory Data Validation Functional Guidelines (4, 5) were used to supplement HAZWRAP guidelines when no acceptance ranges or control limits were established.

When samples were received by the laboratory, they were assigned unique laboratory numerical identifiers. The first five digits of the laboratory sample number indicates the sample batch or sample delivery group, while the last three digits identify each unique sample. This sample numbering system ensures that the sample identity is unknown to the analyst. Table 1.1 correlates field sample point to laboratory number for ease in locating specific field sites. Samples were analyzed in the CH2M Hill Laboratories located in Montgomery, Alabama; Gainesville, Florida; and Redding, California.

For ease of discussion, the results of the validation process will be discussed in the following order: organic analyses, inorganic analyses, wet laboratory analysis.

M E M O R A N D U M  
Page 2  
August 23, 1989  
GNV27267.JX.SI

## 2.0 ORGANIC ANALYSES

### 2.1 INTRODUCTION

The organic analyses data generated were reviewed and validated using HAZWRAP Level C Data Validation Guidelines and supplemented using the guidance document *Laboratory Data Validation Functional Guidelines for Evaluating Organics Analyses* (1). The required Level C data deliverables are laboratory control charts and forms analogous to those required in the CLP Statement of Work (SOW) (4). The validation guideline documents list criteria for evaluating the complete data package form by form. A quick review of the forms is useful for understanding the validation process. The forms summarize and present the raw, experimental data. The raw data are included in the data package as supporting documentation.

**Form I--Data Sheet.** This form presents the sample results and the information necessary for calculating holding times and is reviewed for completeness. Holding time is defined as the number of days from the collection of the sample to the extraction and/or analysis. It is important to note that the holding time for extraction is often different for water and soils for the same analytical method. Table 2.1 presents the EPA's recommended holding times.

**Form II--Surrogate Recovery.** This form summarizes the surrogate spike recovery data. Surrogate compounds are the structural homologs of target list compounds, often with deuterium substituted for hydrogen, and are therefore expected to behave similarly during the analysis. Spike recoveries demonstrate laboratory performance and are evaluated using acceptance ranges delineated in the CLP SOW. Spike recoveries can also be used to estimate accuracy, which is a measure of the agreement between an experimental determination and the true value of the parameter being measured.

**Form III--Matrix Spike/Matrix Spike Duplicate (MS/MSD) Recovery.** This form presents the recoveries of the MS/MSD compounds. Matrix spike compounds are found on the method target compound list (TCL). The field sample is split and a portion is spiked with known quantities of TCL compounds to ascertain the effects of the specific sample matrix on the recovery of analytes. Acceptance ranges are delineated in the CLP SOW. MS/MSD spike recoveries can also be used to estimate accuracy and precision. Precision is a measure of the agreement or repeatability of a set of replicate results obtained from duplicate analyses made under the same conditions.

**Form IV--Method Blank Summary.** The method blank summary sheets correlate method blanks to samples. Method blanks are ASTM Type III (distilled, deionized) water that are treated as a sample in the laboratory--in other words, they undergo the same analytical process as the corresponding samples. Method blanks are used to monitor laboratory performance and contamination introduced during the analytical procedure. The usual frequency is 1 in 10 or 20 (depending on the analytical method) or one per batch, whichever is more frequent.

MEMORANDUM  
Page 3  
August 23, 1989  
GNV27267.JX.SI

**Form V--GC/MS Tuning and Mass Calibration.** This form presents the tuning and mass calibration information for each GC/MS instrument used to produce data in the data package. The CLP SOW establishes tuning and performance criteria to ensure mass resolution, identification, and, to some degree, sensitivity. These criteria are not sample specific; conformance is determined using standard materials. Therefore, these criteria should be met in all circumstances. For volatiles analyses, Bromofluorobenzene (BFB) is used; and for semi-volatiles, Decafluorotriphenylphosphine (DFTPP) is employed. Tuning compounds for PCB, EDB, and PAH using GC/MS are not reported. Analysis for PCB, EDB, and PAH using a gas chromatograph require no tuning process.

**Form VI and VII--Initial and Continuing Calibration.** This form is used to report compound recoveries from calibration solutions. Initial calibration data demonstrate that the analytical instrument is performing satisfactorily and is capable of producing acceptable quantitative data at the beginning of the analytical period. Continuing calibration checks document that the instrument continues to produce acceptable data. Calibration spike recoveries must fall within a tight acceptance window in order for analysis to begin or continue.

**Form VIII--Internal Standards.** This form presents the internal standards peak area information. Internal standard compounds are used to ensure that analytical instrument sensitivity and response is stable during every run. Acceptance criteria are established in the Functional Guidelines.

**Form VIIIIB--Pesticide Evaluation Standards Summary.** This form is used to report the 72-hour analytical sequence for pesticide analysis. The instrument is calibrated at the beginning of the 72-hour analytical sequence and then the calibration is checked every five samples. Note that a pesticide/PCB analysis was not performed in this work plan.

**Form IX--Pesticide/PCB Standards Summary.** This form is only included for pesticide/PCB analyses and is used to monitor variations in the calibration factor and retention time for each pesticide/PCB standard during each 72-hour period. The calibration factor is the ratio of the total chromatographic peak area of a standard to the concentration of the standard in the sample; it should remain constant over time. This factor demonstrates that the chromatographic system is operating consistently over time. Retention time is the residence time of an analyte on the chromatographic column and also should remain constant over time. Acceptance ranges for both calibration factor and retention time are delineated in the CLP SOW. Note that a pesticide/PCB analysis was not performed in this work plan.

**Form X--Pesticide/PCB Identification.** This form is only included in the Pesticide/PCB data package and it summarizes the tentative and confirmed identity of all TCL pesticides and PCBs detected in a given sample. If any pesticide or PCBs are detected above the detection limit on the first column, then a second, different

**M E M O R A N D U M**

Page 4

August 23, 1989  
GNV27267.JX.SI

chromatographic column is used to confirm both the identity and quantification of the pesticide or PCB. Note that a pesticide/PCB analysis was not performed in this work plan.

Supporting documentation is also thoroughly reviewed. Areas for review include TCL compound identification, compound quantification and reported detection limits, and tentatively identified compounds.

Included with the field samples were trip blanks. This blank consists of ASTM Type III water that is prepared in the laboratory before sampling. The water is stored in volatile organic analysis (VOA) bottles, not opened in the field, and travels back to the laboratory with the other VOA GC and GC/MS samples. This blank monitors possible contamination introduced during the sample bottle trip; the usual frequency is one trip blank per shipping container.

**2.2 ORGANIC DATA VALIDATION SUMMARY TABLES**

Before the analytical results are released from the laboratory, careful review of both the sample and the quality control data is required. Laboratory personnel review the raw data to verify sample identity, instrument calibration, detection limits, numerical computations, accuracy of transcriptions, and chemical interpretations. Additionally, the quality control samples are processed to demonstrate that the analytical results are within laboratory-prescribed criteria for accuracy and precision. This technical memorandum includes only summary tables for the data validation process; the original data sheets and data summary tables appear in other sections of the report.

Data validation summary tables presented in this section are a summary of the Quality Assurance/Quality Control (QA/QC) information for each laboratory sample batch by analyses. The tables are arranged by analyses and separated by sample delivery group (the first five digits of laboratory sample number).

Sample QA/QC information presented in the summary tables includes MS/MSD percent recovery and precision, surrogate spike recovery, holding time, and laboratory method blank analyses. Data validation summary tables organize samples by the corresponding MS/MSD samples. Data that do not strictly meet the criteria are qualified with flags, single letter abbreviations that indicate a problem with the data. Although the flags originate in the data validation section, they are included in the data summary tables (in the main body of the text) so that data will not be used indiscriminately. Acceptable matrix spike recovery ranges are defined in the appropriate SW 846 method (3). No surrogate recovery control limits are established in the SW 846 methods. Acceptable ranges for surrogate recoveries from the CLP SOW (4) were applied to semivolatiles and VOA GC/MS because the CLP methods are analogous. For the PAH GC/MS analysis, acceptable ranges for the terphenyl surrogate are taken from SW 846 methodology. Tables 2.2 and 2.3 summarize the acceptable limits for each analysis and a source reference. Flags used in the text include:

- U** Undetected. Analyte was analyzed for but not detected above the method detection limit.
- B** Analyte was not detected above 5 times (10 times for common laboratory solvents) the concentration reported in the laboratory blank.

M E M O R A N D U M  
Page 5  
August 23, 1989  
GNV27267.JX.SI

- J      Estimated. Analyte was present but the reported value may not be accurate or precise. For example, the MS/MSD precision is outside the acceptable range and the data may be biased high or low.
- K      Analyte was present but the reported value may be biased high; the actual value is expected to be lower. For example, the surrogate spike recovery was above the acceptable limits.
- L      Analyte was present but the reported value may be biased low; the actual value is expected to be higher. For example, the holding time was exceeded or the surrogate spike recovery was below the acceptable limits.
- M      Duplicate precision was not met. It is not possible to determine whether the resulting bias is high or low.

It is important to note that the Data Summary Sheets, Form I, also have flags on them and the usage is the same as listed above. Additionally, under the current CLP SOW, the laboratory is required to report any analyte concentration that is above the instrument detection limit but below the Contract Required Quantification Limit (CRQL). These analyte concentrations are flagged "J" for data estimated.

The summary tables for a given analytical method are presented by laboratory number (in ascending sequential order). The data validation summary tables are discussed below by category in the same order that they appear. The order for the data validation summary tables is listed below.

<u>Analysis</u>	<u>Table Numbers</u>
Semivolatiles	2.4-2.7
Volatiles GC/MS	2.8
Volatile Halocarbons	2.9-2.13
Volatiles Aromatics	2.14-2.18
PAH GC/MS	2.19-2.21
EDB GC and GC/MS	2.22-2.26
PCB GC/MS	2.27-2.28
TOC	3.1-3.3
TSS	3.4-3.5
Metals	4.1-4.5

M E M O R A N D U M  
Page 6  
August 23, 1989  
GNV27267.JX.SI

### 2.2.1 Semivolatiles

In some soil samples only base/neutral reporting was requested (for PAH content); however, the analysis was performed as if a full target compounds list was required. For semivolatile analysis, one surrogate per fraction (acid or base/neutral) can be outside the acceptance range without the data being flagged as long as the recovery is equal or greater than 10 percent.

In Table 2.4 the MS recovery for 2-chlorophenol is below the acceptance range and flagged "L", estimated low. Recovery from the MSD was above acceptance range for 4-nitrophenol and flagged "K", estimated high. All acid fraction recoveries from the MS are significantly lower than the MSD recoveries. The low recoveries are consistent with the low surrogate values also reported. The case narrative suggests the sample pH was improperly adjusted before extraction of the acid fraction. No qualifying of the data set is supported because of the low recovery.

Drainageway water sample 4 OWS had two surrogate values below acceptable range. Sample reanalysis provided acceptable surrogate recoveries. Drainageway water sample R5C was reanalyzed at a high dilution because of the presence of high concentration, non target compounds and viscosity of the extract. The surrogates were diluted below the level of detection and could not be evaluated.

The common contaminant bis(2-ethyl-hexyl)phthalate was present in the trip, field, and laboratory blanks. All samples containing this contaminant at concentrations below 10 times the blank level are flagged "B", blank contamination.

In Table 2.5 the spike recoveries for phenol are above the acceptable range, and flagged "K", estimated high. No qualifying of the data set is supported because of the low recovery.

The common contaminant bis(2-ethyl-hexyl)phthalate was detected in the rinse and field blank. The blank samples are water matrixes and direct comparison of concentration values to soil matrixes is inappropriate. Because the phthalate was reported in the blanks and some soil samples, the data user should suspect that low concentration contamination occurred. No blank contamination flags were added to the data.

In Table 2.6 the initial calibration and continuing calibration each have one outlier. The calibration compound outliers are not reported in any of the samples; therefore, no action is required.

The method blank for the sample batch contained the common contaminant bis(2-ethyl-hexyl)phthalate. All samples containing this contaminant at concentrations below 10 times the blank level are flagged "B", blank contamination.

In Table 2.7 the matrix spike recovery for 4-nitrophenol is above acceptable range and flagged "K", estimated high. Matrix spike recovery for phenol was below acceptable range and flagged "L", estimated low. No qualification of the data set is made on the basis of spike recovery.

Surrogate recoveries for groundwater sample 3E-6, MS, and MSD (the MS/MSD were spiked in sample 3E-6) were below the acceptable range for phenanthrene-d10. No

**M E M O R A N D U M**

Page 7

August 23, 1989

GNV27267.JX.SI

reanalysis was required because the MS/MSD analyses substantiate the low recovery in the sample.

The laboratory, field, rinse, and trip blank were contaminated with bis(2-ethylhexyl)phthalate. All samples containing this contaminant at concentrations below 10 times the laboratory blank level are flagged "B", blank contamination.

Because of a calibration outlier, the reported concentration of benzoic acid in groundwater sample WP4-1 is flagged "J", estimated.

**2.2.2 Volatiles GC/MS**

In Table 2.8, groundwater sample 3E-6 contains a high concentration of acetone and the laboratory blank is contaminant free. Reanalysis of the sample at a 1:100 dilution brought acetone into calibration range of the instrument but the laboratory blank also contained acetone as a contaminant. Acetone is present in the sample as demonstrated by the first analysis; however, the concentration is not quantified accurately and so is flagged "J", estimated with unknown bias. All other QA/QC measures are within acceptable range and no further qualification is required.

**2.2.3 Volatile Halocarbons**

Tables 2.9 through 2.13 summarize the QA/QC data for the purgeable halocarbons analysis. No surrogate recovery control limits are established for this method; instead, the performing laboratory established its own monitoring program. Blank spike control charts provided by the laboratory are used to evaluate surrogate recovery performance. Analytical difficulties encountered by the laboratory in performing this method were cause to qualify all reported data. Discussion of the problems that affect all samples are presented.

The method requires that calibration standards at a minimum of three concentration levels for each parameter be used to calibrate the GC system. One of the external standards used in calibrating the instrument should be at a concentration near but above the method detection limit; the other concentrations should correspond to the expected range of concentrations in real samples. The results can be used to prepare a calibration curve for each analyte. Alternatively, if the ratio of response to concentration (calibration factor) is constant over the working range (i.e., less than 10 percent relative standard deviation (RSD)), linearity through the origin can be assumed and the average calibration factor used in place of a calibration curve. Additionally, a continuing calibration check standard should be analyzed routinely to verify the performance of the GC. In all five sample batches the 10 percent RSD criteria for initial calibration linearity and the 15 percent D criteria for continuing calibration check difference were routinely missed; therefore, performance of the chromatographic system is in doubt and all reported analyte concentrations are flagged "J", estimated with unknown bias.

There are three significant points that support the reliability of the data. First, matrix spike samples (spiked at 20 µg/l, water; 2 mg/kg, soil) are reasonably recovered, which indicates good system performance in the concentration region of 20 µg/l in water and 2 mg/kg in soil. Secondly, calibration performance does not affect qualitative assessment (assignment of peak identity) of the compounds (this has some restrictions which will be discussed below). Third, one initial calibration standard containing component concentration at

M E M O R A N D U M

Page 8

August 23, 1989  
GNV27267.JX.SI

the method detection limit was analyzed. This is important in that the laboratory has demonstrated the ability to detect concentrations at 1  $\mu\text{g/l}$  in water and 0.1 mg/kg in soil.

One basis for reporting a positive result is whether the analyte response is equal to or greater than 1  $\mu\text{g/l}$  in water or 0.1 mg/kg in soil. The accuracy of the mean relative response factor, which is used to calculate concentration, is uncertain. Because of the inaccurate response factor some analyte responses may be calculated below the reporting criteria and reported as nondetects even though concentrations of purgeable halocarbons may actually be present at levels approximately the reported detection limit.

The concentration ranges that are most affected by the calibration error are those at or near the method detection limit. This is demonstrated by reviewing the initial calibration response factor variability. Components in the low concentration calibration standard are the furthest from the mean relative response factor.

All samples with reported sample concentrations are flagged "J", estimated with unknown bias. The data user should recognize that samples that report analytes "less than" may contain analytes in lower concentrations.

#### 2.2.4 Volatile Aromatics

Tables 2.14 through 2.18 summarize the QA/QC data for the purgeable aromatic analysis. No surrogate recovery control limits are established for this method; instead, the performing laboratory established its own monitoring program. Blank spike control charts provided by the laboratory are used to evaluate surrogate recovery performance.

In Table 2.14 matrix spike recovery for 1,4-dichlorobenzene is below the acceptable range and flagged "L", estimated low. No additional action is taken because samples did not contain this compound. The laboratory blank contained toluene at 1  $\mu\text{g/l}$ . All samples containing the common contaminant toluene at less than 10 times the reported blank concentration were flagged "B", blank contamination.

In Table 2.15, the surrogate recovery for drainageway sediment sample R4C is above acceptable range and flagged "K", estimated high. All other QA/QC measures were within acceptance range and additional qualification is not required.

In Table 2.16 the matrix spike recoveries were both above and below acceptable range and flagged "J", estimated, for tert butyl methyl ether. Precision is also unacceptable. Precision criteria were above the acceptable range for ethyl benzene and o-xylene and flagged "J", estimated. The imprecision may be related to purging efficiencies of the MS and MSD, but this data could not be evaluated because the surrogate recoveries were not reported. All samples with reported concentrations of these compounds are flagged "J", estimated.

In Table 2.17 all the QA/QC measures for purgeable aromatic analysis of soil are within acceptable ranges. The data are acceptable and can be used without qualification.

**M E M O R A N D U M**  
Page 9  
August 23, 1989  
GNV27267.JX.SI

In Table 2.18 matrix spike recoveries for tert butyl methyl ether are both above and below acceptable ranges and flagged "J", estimated. All samples with reported concentrations of this compound are flagged "J", estimated.

Holding time was exceeded for groundwater samples 3E-GW-WP8 and 1-GW-WP4. These samples did not contain any reportable concentrations of analytes and no action was taken. The data user should be aware that samples analyzed outside of holding time may have lost volatile components because of diffusion through the sample container.

Because of a continuing calibration outlier for ethyl benzene, all samples containing this component are flagged "J", estimated.

#### **2.2.5 Polynuclear Aromatic Hydrocarbons**

No specific surrogate or matrix spike compounds are required in the method. The compounds reported are representative of the PAH group of compounds, and therefore are appropriate. Acceptance ranges for matrix spike and surrogate recoveries are selected from EPA Method 8270. No acceptance ranges for MS/MSD precision are established. The reviewer used professional judgement to evaluate the precision.

Control charts of blank spike data were evaluated using EPA recommended ranges because the laboratory did not have 20 data evaluation points. All blank spikes were within acceptable ranges.

In Table 2.19 all the QA/QC measures for PAH analysis of soils are within acceptable ranges. The data are acceptable as is and can be used without qualification.

In Table 2.20 all the QA/QC measures for PAH analysis of groundwater are within acceptable ranges. The data are acceptable as is and can be used without qualification.

In Table 2.21 the surrogate recovery for groundwater sample 1-GW-WP5 is below the acceptable range and flagged "L", estimated low. No analytes were detected in the sample and the method detection limits may be elevated.

#### **2.2.6 Ethylene Dibromide**

Soil samples are analyzed by a laboratory modified method where mass spectrophotometer detection is substituted for electron capture (EC) detection. The method for soil analysis is acceptable.

No specific surrogate or matrix spike compounds are required in the method. The compounds reported were EDB or representative of EDB and therefore are appropriate. No acceptance ranges for matrix spike recoveries, surrogate recoveries, and MS/MSD precision are established. The reviewer used professional judgement to evaluate these quantitative parameters.

Because EPA acceptable ranges for 20 data evaluation points were not available to evaluate blank spike control charts, the reviewer used professional judgement. All blank spikes are acceptable.

M E M O R A N D U M  
Page 10  
August 23, 1989  
GNV27267.JX.SI

Tables 2.22 through 2.26 summarize the QA/QC data for the EDB analysis. All QA/QC measures are within acceptance limits. The data are acceptable as is and can be used without qualification.

#### 2.2.7 Polychlorinated Biphenyls

The laboratory substituted mass spectrophotometer detection for EC detection and used the surrogate 4-bromobiphenyl. The method substitutions for soil analysis are acceptable.

No specific surrogate or matrix spike compounds are required in the method. The compounds reported were PCB or representative of PCB and therefore are appropriate. No acceptance ranges for matrix spike recoveries, surrogate recoveries, and MS/MSD precision are established. The reviewer used professional judgement to evaluate these quantitative parameters.

Because EPA acceptable ranges for 20 data evaluation points were not available to evaluate blank spike control charts the reviewer used professional judgement. All blank spikes are acceptable.

Tables 2.27 and 2.28 summarize the QA/QC data for the PCB analysis. All QA/QC measures are within acceptance limits. The data are acceptable as is and can be used without qualification.

### 3.0 WET CHEMISTRY

Samples analyzed by wet chemistry methods do not have format-specific deliverables. The review of this data consists of checking that the following QA/QC was performed and acceptable: initial calibration or calibration verification, MS/MSD, laboratory blank, blank spike, and control charts.

#### 3.1 TOTAL ORGANIC CARBON

In Tables 3.1 through 3.3 all QA/QC measures are within acceptable ranges and the supporting documentation is present. The data are acceptable and can be used without qualification.

#### 3.2 TOTAL SUSPENDED SOLIDS

In Tables 3.4 and 3.5 no matrix spike was performed on site-specific samples. Qualification is unnecessary based on the deficiency because a control blank spike was performed. All other QA/QC measures are within acceptable ranges and the supporting documentation is present. The data are acceptable and can be used without qualification.

### 4.0 METALS ANALYSES

#### 4.1 INTRODUCTION

Metal analyses data are reviewed and validated using HAZWRAP Level C Data Validation Guidelines and supplemented using the guidance document "Laboratory Data Validation Functional Guidelines for Evaluating Inorganic Analyses" (5).

M E M O R A N D U M  
Page 11  
August 23, 1989  
GNV27267.JX.SI

The required Level C data deliverables are laboratory control charts and the forms used in the CLP Statement of Work (SOW). A quick review of the forms is useful for understanding the validation process. The forms summarize the raw, experimental data.

**Form I--Data Sheet.** This form presents the sample results and is reviewed for completeness.

**Form IIA--Initial and Continuing Calibration Verification.** This form is used to report analyte recoveries from calibration solutions. Initial calibration data demonstrate that the analytical instrument is performing satisfactorily and is capable of producing acceptable quantitative data at the beginning of the analytical period. Continuing calibration checks document that the instrument continues to produce acceptable data. Calibration spike recoveries must fall within a tight acceptance window in order for analysis to begin or continue.

**Form IIB--CRDL Standard for AA and ICP.** This form is used to report analyte recoveries from analyses of the Contract Required Detection Limits (CRDL) standards for AA and ICP. The laboratory analyzes a standard solution that is twice the Instrument Detection Limit (IDL) to verify the linearity of the instrument at low detection limits.

**Form III--Blanks.** This form is used to report analyte concentrations detected in the Initial Calibration Blank (ICB), Continuing Calibration Blanks (CCB), and the Preparation Blank (PB). Method blanks are used to determine the existence and magnitude of contamination problems. If problems with any blank exist, all data associated with that sample delivery group must be carefully evaluated to determine if there is a problem with the entire analytical group or it is an isolated incident.

**Form IV--ICP Interference Check Sample (ICS).** This form is used to report ICS results for each ICP instrument used. The ICS is a mixture of analytes that have a potential for interference; it is performed to verify the laboratory's interelement and background correction factors.

**Form VA--Spike Sample Recovery.** This form is used to report results for the predigestion spike recovery. This spike recovery measurement is analogous to the MS/MSD spike recovery for organic analyses in that it measures the effects of the sample matrix on the recovery of a known quantity of analyte. Additionally, it also measures the efficiency of the digestion process. If the predigestion spike recovery does not fall within preset limits (usually 75 to 125 %), then a postdigestion spike is added and the sample reanalyzed.

**Form VB--Postdigestion Spike Sample Recovery.** This form is used to report recovery results for the above mentioned postdigestion spike. Again the preestablished acceptance limit for recovery is 75 to 125%. If both the pre and postdigestion spike recovery is outside the acceptance limits, this is considered positive evidence of matrix interferences, and the data is flagged "J", estimated.

**M E M O R A N D U M**

Page 12

August 23, 1989  
GNV27267.JX.SI

**Form VI--Duplicates.** This form is used to report the results of duplicate laboratory analysis rather than a field duplicate. This duplicate differs from the MSD used in organic analyses in that the analyte concentration measured is native to the sample rather than that which has been added (spiked). Duplicate analyses are required for calculating percent solids (for soil samples) and all analyte results. Duplicate data are used to calculate precision for all analyte concentrations greater than 5 times the CRDL. Acceptance limits are set at 0 to 20%.

**Form VII--Laboratory Control Sample.** This form is used to report the recovery results for the standard Laboratory Control Sample (LCS). The LCS analysis is designed to serve as a monitor of the efficiency of the digestion procedure and analyte recoveries must fall within acceptance limits (usually 90 to 110 %).

**Form VIII--Standard Addition Results.** This form is used to report the results of samples analyzed using the Method of Standard Additions and is only used for Graphite Furnace Atomic Absorption analysis. Duplicate injections and furnace postdigestion spike recoveries are used to establish the precision and accuracy of the individual analytical determinations. For all analyte concentrations greater than 5 times the CRDL, acceptance limits of 0 to 20% relative standard difference have been established in the CLP SOW.

**Form IX--Inductively Coupled Plasma Serial Dilution.** This form is used to report results for Inductively Coupled Plasma (ICP) serial dilution, which determines whether significant physical or chemical interferences exist due to sample matrix effects. For any analyte whose concentration is 50 times greater than the IDL, the sample is diluted and the results compared (diluted versus undiluted) for agreement (precision).

**Form X--Holding Times.** This form is used to report holding times for mercury (28 days) and cyanide (14 days). Samples that are not analyzed within the holding times are flagged "L" for biased low.

**Form XI--Instrument Detection Limits (Quarterly).** This form documents the quarterly IDL study conducted by the laboratory for each instrument used to produce the data package. Additionally, the raw experimental and supporting documentation are thoroughly reviewed. Areas for review include: analyte quantification and reported detection limits, strip chart recordings, and instrument data system printouts.

#### **4.2 INORGANIC DATA VALIDATION SUMMARY TABLES**

Each table presents the validation information for one sample delivery group and sample matrix. Data nonconformances are indicated with flags in the appropriate block and the nonconformance is discussed in the corresponding text section. Although the flags originate in the data validation section, they are included on the data summary tables (in the main body of the text) so that data will not be used indiscriminately. Control limits are delineated in the appropriate method (3) or utilized from the CLP SOW (5) when the method does not have

M E M O R A N D U M

Page 13

August 23, 1989

GNV27267.JX.SI

established control limits. The acceptable limits for each analysis and a source reference are included in Table 2.3. The text is organized by sample delivery groups.

No calibration data was included in any of the five data packages. A blank and at least one standard must be used to establish the analytical curve for elements analyzed by ICP. A blank and at least three standards, one of which must be at the CRDL, must be used in establishing the analytical curve for elements analyzed by Atomic Absorption (AA). Instead an Initial Calibration Verification standard (ICV) was analyzed at the start of the day's analysis. The ICV standard was within the acceptance limits (90 to 110% Recovery) and the ICP is known to be a stable instrument over time, so no action is taken in regard to the missing calibration.

Holding times were reported for mercury analysis and are acceptable. No holding times were reported for the remaining elements and are assumed to be met because the data reporting date preceded holding time expiration. Analysis dates are also inferred from control chart documentation but inconsistent reporting made this source unreliable.

In Table 4.1 the LCS result is not provided for silver. The spike and duplicate results for silver were acceptable. Because no acceptance ranges are established for silver and other QC criteria are met, qualifications are not imposed.

The trip blank was used for the mercury matrix spike and duplicate. Using this sample does not provide a reliable test for matrix effect; however, no qualification is supported based on this error.

Chromium concentration values less than 5 times the amount present in the preparation blank are flagged "B", blank contamination.

In Table 4.2 the matrix spike for lead is below the acceptance range and flagged "L", estimated low. The native sample concentration was twice the amount of the spike and contributed to the low recovery.

LCS recoveries are below acceptance range for chromium and selenium and are flagged "L", estimated low. All samples with chromium concentrations greater than CRDL are flagged "L." Samples containing selenium are less than CRDL and flags are not needed.

Insufficient raw data are available to apply the aqueous preparation blank contamination to the soil data.

In Table 4.3 barium and lead are reported in the preparation blank and are flagged "B", blank contamination. These elements are also flagged in samples with less than 5 times the reported preparation blank level. All other QA/QC measures are acceptable and no additional action is required.

In Table 4.4 LCS recoveries for arsenic and selenium are below the acceptance range and flagged "L", estimated low. Lead matrix spike recovery is above acceptable range and flagged "K", estimated high. The case narrative states the sample was heterogenous and may have contributed to the recovery difficulty. Samples reporting these elements above CRDL are flagged "L."

M E M O R A N D U M  
Page 14  
August 23, 1989  
GNV27267.JX.SI

As shown in Table 4.5, a lead predigestion matrix spike was not performed. Although a postdigestion spike was found acceptable, samples containing lead are flagged "J", estimated bias unknown.

Chromium and selenium are flagged "M", duplicate precision not met. Only chromium in groundwater sample WP3E-6 had a concentration greater than CRDL; it is flagged "M."

Matrix spike recovery for mercury is below the acceptance range and flagged "L", estimated low.

## 5.0 CONCLUSIONS

The Organic data were reviewed and validated using the HAZWRAP Level C Validation Guidelines and supplemented with the EPA Functional Guidelines. The data are acceptable with qualifications as noted in the discussion in Section 2. The wet chemistry data were reviewed and validated using the HAZWRAP Level C Validation Guidelines. The data are acceptable without qualifications. The inorganic data have been reviewed and validated using the HAZWRAP Level C Validation Guidelines and supplemented with the EPA Functional Guidelines. The data are acceptable with qualifications as noted in the discussion in Section 4.

## 6.0 REFERENCES

1. U.S. EPA. *Laboratory Data Validation Functional Guidelines for Evaluating Organic Analyses*, 1988 revision.
2. U.S. EPA. *Laboratory Data Validation Functional Guidelines for Evaluating Inorganics Analyses*, 1988 revision.
3. U.S. EPA. *Test Methods for Evaluating Solid Waste (SW-846)*, Third edition, September 1986.
4. U.S. EPA *Contract Laboratory Program Statement of Work for Organic Analyses*, 1988 revision.
5. U.S. EPA *Contract Laboratory Program Statement of Work for Inorganic Analyses*, 1988 revision.
6. U.S. Department of Energy, Hazardous Waste Remedial Actions Program. *Requirements for Quality Control of Analytical Data*. DOE/HWP-65. Prepared by Martin Marietta Energy Systems, Inc. August 1988.

Table 1.1  
FIELD SAMPLE LIST AND ANALYTICAL METHOD PERFORMED

<u>Field Sample</u>	<u>Date Sampled</u>	<u>Sample Matrix</u>	<u>Lab Number</u>	<u>Analytical Method</u>
				a b c d e f g h i j
R4U	05/26/89	SOIL	13572001	X X
R4C	05/26/89	SOIL	13572002	X X X X
R4D	05/26/89	SOIL	13572003	X X
R4C	05/26/89	WATER	13572004	X X X X X
R3U	05/26/89	SOIL	13572005	X X
R3C	05/26/89	SOIL	13572006	X X X X
R3D	05/26/89	SOIL	13572007	X X
R3C	05/26/89	WATER	13572008	X X X X X
SITE 1 CREEK C.P.	05/26/89	SOIL	13572009	X X
SITE 1 CREEK M.O.	05/26/89	SOIL	13572010	X X
R2U	05/26/89	SOIL	13572011	X X
R2C	05/26/89	SOIL	13572012	X X X X
R2D	05/26/89	SOIL	13572013	X X
R2C	05/26/89	WATER	13572014	X X X X X
R1U	05/26/89	SOIL	13572015	X X X
R1C	05/26/89	SOIL	13572016	X X X X X
R1D	05/26/89	SOIL	13572017	X X X
R1C	05/26/89	WATER	13572018	X X X X X
SITE 4 OWS OUTFALL	05/26/89	SOIL	13572019	X X
SITE 4 OWS OUTFALL	05/26/89	WATER	13572020	X X X X X
R5D	05/26/89	SOIL	13572021	X
R5C	05/26/89	SOIL	13572022	X X X
R5C	05/26/89	WATER	13572023	X X X X X
RINSE WATER BLANK	05/26/89	WATER	13572024	X X X X X
TRIP BLANK	05/26/89	WATER	13572025	X X X X X
MATRIX SPIKE	05/26/89	WATER	13572M26	X X X
MATRIX SPIKE DUP.	05/26/89	WATER	13572D27	X X X
DUPLICATE	05/26/89	WATER	13572P28	X
MATRIX SPIKE	05/26/89	SOIL	13572M29	X X X X X
MATRIX SPIKE DUP.	05/26/89	SOIL	13572D30	X X X X X
DUPLICATE	05/26/89	SOIL	13572P31	X
MATRIX SPIKE	05/26/89	SOIL	13572M32	X
DUPLICATE	05/26/89	SOIL	13572P33	X
3E-GW-WP1	06/09/89	WATER	13675001	X

- a Volatile Halocarbons/Aromatics
- b Volatiles (GC/MS)
- c Polynuclear Aromatic Hydrocarbons
- d PCB
- e Semivolatiles
- f EDB
- g Priority Pollutant Metals
- h Lead
- i Total Suspended Solids
- j Total Organic Carbon

Table 1.1  
(Continued)

<u>Field Sample</u>	<u>Date Sampled</u>	<u>Sample Matrix</u>	<u>Lab Number</u>	<u>Analytical Method</u>
				a b c d e f g h i j
3E-GW-WP2	06/09/89	WATER	13675002	X
3E-GW-WP3	06/09/89	WATER	13675003	X
3E-GW-WP4	06/09/89	WATER	13675004	X
3E-GW-WP5	06/09/89	WATER	13675005	X
3E-GW-WP8	06/09/89	WATER	13675006	X
3E-GW-WP9	06/09/89	WATER	13675007	X
3E-GW-WP10	06/09/89	WATER	13675008	X
3W-GW-WP1	06/09/89	WATER	13675009	X
3W-GW-WP2	06/09/89	WATER	13675010	X
3W-GW-WP3	06/09/89	WATER	13675011	X X
3W-GW-WP4	06/09/89	WATER	13675012	X
7-GW-WP1	06/09/89	WATER	13675013	X
7-CW-WP3	06/09/89	WATER	13675014	X
7-GW-WP4	06/09/89	WATER	13675015	X
7-GW-WP6	06/09/89	WATER	13675016	X
7-GW-WP7	06/09/89	WATER	13675017	X
4-GW-WP1	06/09/89	WATER	13675018	X X
4-GW-WP2	06/09/89	WATER	13675019	X
4-GW-WP3	06/09/89	WATER	13675020	X
4-GW-WP10	06/09/89	WATER	13675021	X
1-GW-WP10	06/09/89	WATER	13675022	X
1-GW-WP2	06/09/89	WATER	13675023	X
1-GW-WP3	06/09/89	WATER	13675024	X
1-GW-WP4	06/09/89	WATER	13675025	X
1-GW-WP5	06/09/89	WATER	13675026	X
1-GW-WP6	06/09/89	WATER	13675027	X X
8-GW-WP1	06/09/89	WATER	13675028	X X
8-GW-WP2	06/09/89	WATER	13675029	X
8-GW-WP3	06/09/89	WATER	13675030	X X
8-GW-WP4	06/09/89	WATER	13675031	X
8-GW-WP10	06/09/89	WATER	13675032	X
6-GW-WP1	06/09/89	WATER	13675033	X
6-GW-WP2	06/09/89	WATER	13675034	X
6-GW-WP3	06/09/89	WATER	13675035	X

- a Volatile Halocarbons/Aromatics
- b Volatiles (GC/MS)
- c Polynuclear Aromatic Hydrocarbons
- d PCB
- e Semivolatiles
- f EDB
- g Priority Pollutant Metals
- h Lead
- i Total Suspended Solids
- j Total Organic Carbon

Table 1.1  
(Continued)

<u>Field Sample</u>	<u>Date Sampled</u>	<u>Sample Matrix</u>	<u>Lab Number</u>	<u>Analytical Method</u>									
				<u>a</u>	<u>b</u>	<u>c</u>	<u>d</u>	<u>e</u>	<u>f</u>	<u>g</u>	<u>h</u>	<u>i</u>	<u>j</u>
5-GW-WP3	06/09/89	WATER	13675036							X			
TRAVEL BLANK	06/09/89	WATER	13675037							X	X	X	
FIELD BLANK	06/09/89	WATER	13675038							X	X	X	
EQUIPMENT BLANK	06/09/89	WATER	13675039							X	X	X	
MATRIX SPIKE	06/09/89	WATER	13675M43									X	
DUPLICATE	06/09/89	WATER	13675P44									X	
MATRIX SPIKE	06/09/89	WATER	13675M45									X	
DUPLICATE	06/09/89	WATER	13675P46									X	
3E-SL-WP6-1@1.5-2FT	06/07/89	SOIL	13676001	X		X	X					X	
3E-SL-WP6-2@3.5-4FT	06/07/89	SOIL	13676002	X		X	X					X	
3E-SL-WP7-1@3.5-4FT	06/07/89	SOIL	13676003	X		X						X	
3E-SL-WP1-1@3.5-4FT	06/07/89	SOIL	13676004	X		X						X	
3W-SL-WP1-1@4-4.5FT	06/07/89	SOIL	13676005	X		X						X	
3W-SL-WP5-1@3.5-4FT	06/07/89	SOIL	13676006	X		X						X	
7-SL-WP2-1@3.5-4FT	06/07/89	SOIL	13676007	X		X						X	
7-SL-WP5-1@3.5-4FT	06/07/89	SOIL	13676008	X		X						X	
4-SL-WP1-1@1-1.5FT	06/07/89	SOIL	13676009	X				X	X				X
4-SL-WP10-1@1-1.5FT	06/07/89	SOIL	13676010	X			X	X					X
4-SL-WP1-2@3-3.5FT	06/07/89	SOIL	13676011	X		X							X
4-SL-WP2-1@2.5-3FT	06/07/89	SOIL	13676012	X		X							X
4-SL-WP3-1@0.5-1FT	06/07/89	SOIL	13676013	X		X							X
1-SL-WP1-1@0.5-1FT	06/07/89	SOIL	13676014	X		X							X
1-SL-WP10-1@0.5-1FT	06/07/89	SOIL	13676015	X		X							X
1-SL-WP2-1@3.5-4FT	06/07/89	SOIL	13676016	X		X							X
1-SL-WP3-1@2-2.5FT	06/07/89	SOIL	13676017	X				X	X	X			X
1-SL-WP4-1@2.5-3FT	06/07/89	SOIL	13676018	X		X							X
8-SL-WP1-1@2-2.5FT	06/07/89	SOIL	13676019	X				X	X	X			X
8-SL-WP3-1@2.5-3FT	06/07/89	SOIL	13676020	X		X							X
8-SL-WP4-1@2.5-3FT	06/07/89	SOIL	13676021	X		X							X
8-SL-WP10-1@2.5-3FT	06/07/89	SOIL	13676022	X		X							X
5-SL-WP3-1@1-1.5FT	06/07/89	SOIL	13676023	X		X	X						X
5-SL-WP3-2@4-4.5FT	06/07/89	SOIL	13676024	X		X	X						X
5-SL-WP2-1@2-2.5FT	06/07/89	SOIL	13676025	X		X	X						X
6-SL-WP1-1@4.5-5FT	06/07/89	SOIL	13676026	X									X

- a Volatile Halocarbons/Aromatics
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- d PCB
- e Semivolatiles
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- g Priority Pollutant Metals
- h Lead
- i Total Suspended Solids
- j Total Organic Carbon

Table 1.1  
(Continued)

<u>Field Sample</u>	<u>Date Sampled</u>	<u>Sample Matrix</u>	<u>Lab Number</u>	<u>Analytical Method</u>
				a b c d e f g h i j
6-SL-WP2-1@4.5-5FT	06/07/89	SOIL	13676027	X X
MATRIX SPIKE	06/07/89	SOIL	13676M28	X X
MATRIX SPIKE DUP.	06/07/89	SOIL	13676D29	X X
DUPLICATE	06/07/89	SOIL	13676P30	X X
3E-GW-WP1	06/13/89	WATER	13701001	X X
3E-GW-WP2	06/13/89	WATER	13701002	X X
3E-GW-WP3	06/13/89	WATER	13701003	X X
3E-GW-WP4	06/13/89	WATER	13701004	X X
3E-GW-WP5	06/13/89	WATER	13701005	X X
3E-GW-WP8	06/13/89	WATER	13701006	X X
3E-GW-WP10	06/13/89	WATER	13701007	X X
3E-GW-WP9	06/13/89	WATER	13701008	X X
3W-GW-WP1	06/13/89	WATER	13701009	X X
3W-GW-WP2	06/13/89	WATER	13701010	X X
3W-GW-WP3	06/13/89	WATER	13701011	X X
3W-GW-WP4	06/13/89	WATER	13701012	X X
7-GW-WP1	06/13/89	WATER	13701013	X X
7-GW-WP3	06/13/89	WATER	13701014	X X
7-GW-WP4	06/13/89	WATER	13701015	X X
7-GW-WP6	06/13/89	WATER	13701016	X X
7-GW-WP7	06/13/89	WATER	13701017	X X
FIELD BLANK	06/13/89	WATER	13701018	X X
EQUIPMENT BLANK	06/13/89	WATER	13701019	X X
2-GW-WP1	06/13/89	WATER	---	X X
2-GW-WP2	06/13/89	WATER	---	X X
TRAVEL BLANK	06/13/89	WATER	13701020	X X
MATRIX SPIKE	06/13/89	WATER	13701M21	X X
MATRIX SPIKE DUP.	06/13/89	WATER	13701D22	X X
3E-GW-WP6	06/15/89	WATER	13726001	X X X X X X
4-GW-WP2	06/15/89	WATER	13726002	X X
4-GW-WP3	06/15/89	WATER	13726003	X X
4-GW-WP10	06/15/89	WATER	13726004	X X
1-GW-WP1A	06/15/89	WATER	13726005	X X X
1-GW-WP2	06/15/89	WATER	13726006	X X X

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- h Lead
- i Total Suspended Solids
- j Total Organic Carbon

Table 1.1  
(Continued)

<u>Field Sample</u>	<u>Date Sampled</u>	<u>Sample Matrix</u>	<u>Lab Number</u>	<u>Analytical Method</u>
				a b c d e f g h i j
1-GW-WP3	06/15/89	WATER	13726007	X
1-GW-WP4	06/15/89	WATER	13726008	X
1-GW-WP5	06/15/89	WATER	13726009	X
1-GW-WP6	06/15/89	WATER	13726010	X
8-GW-WP2	06/15/89	WATER	13726011	X
8-GW-WP3	06/15/89	WATER	13726012	X
8-GW-WP4	06/15/89	WATER	13726013	X
8-GW-WP10	06/15/89	WATER	13726014	X
5-GW-WP3	06/15/89	WATER	13726015	X
2-GW-WP6	06/15/89	WATER	13726016	X
2-GW-WP9	06/15/89	WATER	13726017	X
2-GW-WP10	06/15/89	WATER	13726018	X
FIELD BLANK	06/15/89	WATER	13726019	X X X
EQUIPMENT BLANK	06/15/89	WATER	13726020	X X X
TRAVEL BLANK	06/15/89	WATER	13726021	X X X
MATRIX SPIKE	06/15/89	WATER	13726M22	X X X
MATRIX SPIKE DUP.	06/15/89	WATER	13726D23	X X X
3E-GW-WP6	06/16/89	WATER	13727001	X
4-GW-WP6	06/16/89	WATER	13727002	X
1-GW-WP2	06/16/89	WATER	13727003	X
8-GW-WP1	06/16/89	WATER	13727004	X
FIELD BLANK	06/16/89	WATER	13727005	X
EQUIPMENT BLANK	06/16/89	WATER	13727006	X
TRAVEL BLANK	06/16/89	WATER	13727007	X
MATRIX SPIKE	06/16/89	WATER	13727M08	X
MATRIX SPIKE DUP.	06/16/89	WATER	13727D09	X
3E-GW-WP1	06/08/89	WATER	23446001	X
3E-GW-WP2	06/08/89	WATER	23446002	X
3E-GW-WP3	06/08/89	WATER	23446003	X
3E-GW-WP4	06/08/89	WATER	23446004	X
3E-GW-WP5	06/08/89	WATER	23446005	X
3E-GW-WP7	06/08/89	WATER	23446006	X
3E-GW-WP8	06/08/89	WATER	23446007	X
3E-GW-WP9	06/08/89	WATER	23446008	X

- a Volatile Halocarbons/Aromatics
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- g Priority Pollutant Metals
- h Lead
- i Total Suspended Solids
- j Total Organic Carbon

Table 1.1  
(Continued)

<u>Field Sample</u>	<u>Date Sampled</u>	<u>Sample Matrix</u>	<u>Lab Number</u>	<u>Analytical Method</u>
				a b c d e f g h i j
3E-GW-WP10	06/08/89	WATER	23446009	X
3W-GW-WP1	06/08/89	WATER	23446010	X
3W-GW-WP2	06/08/89	WATER	23446011	X
3W-GW-WP3	06/08/89	WATER	23446012	X
3W-GW-WP4	06/08/89	WATER	23446013	X
7-GW-WP1	06/08/89	WATER	23446014	X
7-GW-WP3	06/08/89	WATER	23446015	X
7-GW-WP4	06/08/89	WATER	23446016	X
7-GW-WP6	06/08/89	WATER	23446017	X
7-GW-WP7	06/08/89	WATER	23446018	X
4-GW-WP1	06/08/89	WATER	23446019	X
4-GW-WP2	06/08/89	WATER	23446020	X
4-GW-WP3	06/08/89	WATER	23446021	X
4-GW-WP10	06/08/89	WATER	23446022	X
1-GW-WP2	06/08/89	WATER	23446023	X
1-GW-WP10	06/08/89	WATER	23446024	X
1-GW-WP3	06/08/89	WATER	23446025	X
1-GW-WP4	06/08/89	WATER	23446026	X
1-GW-WP5	06/08/89	WATER	23446027	X
1-GW-WP6	06/08/89	WATER	23446028	X
8-GW-WP1	06/08/89	WATER	23446029	X
8-GW-WP2	06/08/89	WATER	23446030	X
8-GW-WP3	06/08/89	WATER	23446031	X
8-GW-WP4	06/08/89	WATER	23446032	X
8-GW-WP10	06/08/89	WATER	23446033	X
6-GW-WP1	06/08/89	WATER	23446034	X
6-GW-WP2	06/08/89	WATER	23446035	X
6-GW-WP3	06/08/89	WATER	23446036	X
5-GW-WP1	06/08/89	WATER	23446037	X
5-GW-WP2	06/08/89	WATER	23446038	X
5-GW-WP3	06/08/89	WATER	23446039	X
FIELD BLANK	06/08/89	WATER	23446040	X
EQUIP.BLANK	06/08/89	WATER	23446041	X X
TRAVEL BLANK	06/08/89	WATER	23446042	X X

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Table 2.1 - Holding Time Limits

Analysis	Method	Extraction		
		Water	Soil	Analysis
PNAs	610/8100	7 days	14 days	40 days
PCBs	608/8080	7 days	14 days	40 days
Volatiles	624/8240	-	-	14 days
Volatiles	601/8010	-	-	14 days
Volatiles	602/8020	-	-	14 days
Semivolatiles	625/8250	7 days	14 days	40 days
Metals by GFAA	7000	-	-	6 mo
Mercury by GFAA	7470	-	-	28 days
Metals by ICP	6000	-	-	6 mo
TOC	415.1/415.2	-	-	-
TSS	160.2	-	-	-

Table 2.2 Summary of Acceptable Recovery Ranges  
for Organic Methods

VOLATILES - EPA METHOD 8240

<u>MS/MSD (% Recovery)</u>	<u>Water</u>	<u>Soil</u>
1,1-Dichloroethene	61-145	59-172
Trichloroethene	71-120	62-137
Chlorobenzene	75-130	60-133
Toluene	76-125	59-139
Benzene	76-127	66-142
<u>Surrogate (% Recovery)</u>	<u>Water</u>	<u>Soil</u>
Toluene	88-110	81-117
4-Bromofluorobenzene	86-115	74-121
1,2-Dichloroethane	76-114	70-121

SEMIVOLATILES - EPA METHOD 8250

<u>MS/MSD (% Recovery)</u>	<u>Water</u>	<u>Soil</u>
1,2,4-Trichlorobenzene	39-98	38-107
Acenaphthene	46-118	31-137
2,4-Dinitrotoluene	24-96	28-89
Pyrene	26-127	35-142
N-Nitroso-Di-n-Propylamine	41-116	41-126
1,4-Dichlorobenzene	36-97	28-104
Pentachlorophenol	9-103	17-109
Phenol	12-89	26-90
2-Chlorophenol	27-123	25-102
4-Chloro-3-Methylphenol	23-97	26-103
4-Nitrophenol	10-80	11-114
Nitrobenzene	35-114	23-120
2-Fluorobiphenyl	43-116	30-115
p-Terphenyl	33-141	18-137
Phenol	10-94	24-113
FROM:2-Fluorophenol	21-100	25-121
2,4,6-Tribromophenol	10-123	19-122

PCB - EPA METHOD 8080

<u>MS/MSD (% Recovery)</u>	<u>Water</u>	<u>Soil</u>
Aroclor 1260	--	--
<u>Surrogate (% Recovery)</u>	<u>Water</u>	<u>Soil</u>
4-Bromophenyl	--	--

Table 2.2 (Cont'd)

## VOLATILES - EPA METHOD 8020

<u>MS/MSD (% Recovery)</u>	<u>Water</u>	<u>Soil</u>
Chloromethane	D-193	D-193
Bromomethane	D-144	D-144
Dichlorodifluoromethane	--	--
Vinyl chloride	D-144	D-144
Chloroethane	46-137	46-137
Methylene chloride	25-162	25-162
Trichlorofluoromethane	21-156	21-156
1,1-Dichloroethene	28-167	28-167
1,1-Dichloroethane	47-132	47-132
trans-1,2-Dichloroethene	38-155	38-155
Chloroform	49-133	49-133
1,2-Dichloroethane	51-147	51-147
1,1,1-Trichloroethane	41-138	41-138
Carbon Tetrachloride	43-143	43-143
Bromodichloromethane	42-172	42-172
1,2-Dichloropropane	44-156	44-156
cis-1,3-Dichloropropene	22-178	22-178
Trichloroethene	35-146	35-146
Dibromochloromethane	24-191	24-191
1,1,2-Trichloroethane	39-136	39-136
trans-1,3-Dichloropropene	22-178	22-178
Bromoform	13-159	13-159
1,1,2,2-Tetrachloroethane	8-184	8-184
Tetrachloroethene	26-162	26-162
Chlorobenzene	38-150	38-150
1,3-Dichlorobenzene	7-187	7-187
1,2-Dichlorobenzene	D-208	D-208
1,4-Dichlorobenzene	42-143	42-143
<u>Surrogate (% Recovery)</u>	<u>Water</u>	<u>Soil</u>
Bromochloromethane	--	--

Table 2.2 (Cont'd)

## VOLATILES - EPA METHOD 8020

<u>MS/MSD (%) Recovery</u>	<u>Water</u>	<u>Soil</u>
Tert Butyl Methyl Ether	--	--
Benzene	39-150	39-150
Toluene	46-148	46-148
Ethyl benzene	32-160	32-160
Xylene	--	--
Chlorobenzene	55-135	55-135
1,4-Dichlorobenzene	42-143	42-143
1,3-Dichlorobenzene	50-141	50-141
1,2-Dichlorobenzene	37-154	37-154

<u>Surrogate (%) Recovery</u>	<u>Water</u>	<u>Soil</u>
Trifluorotoluene	--	--

## PAHs - EPA Method 8100

<u>MS/MSD (%) Recovery</u>	<u>Water</u>	<u>Soil</u>
Naphthalene	22-133	21-133
Acenaphthylene	33-145	33-145
Pyrene	52-115	52-115

<u>Surrogate (%) Recovery</u>	<u>Water</u>	<u>Soil</u>
Terphenyl	33-147	--

## EDB - EPA Method 504

<u>MS/MSD (%) Recovery</u>	<u>Water</u>	<u>Soil</u>
Ethylene Dibromide	--	--
Dibromochloropropane	--	--
1,2-Dibromoethane	--	--

<u>Surrogate (%) Recovery</u>	<u>Water</u>	<u>Soil</u>
Fluorobenzene	--	--
1,1,2,2-Tetrachloroethane	--	--

-- = Acceptable recovery ranges not established.

TABLE 2.3 SUMMARY OF ACCEPTABLE RECOVERY  
RANGES FOR INORGANIC METHODS

<u>Analysis</u>	<u>Method</u>	<u>Control Limits</u>	
		<u>Known Ref</u>	<u>Spike</u>
Cyanide	335.3/9010	80-120	75-120CLP
Lead by GFAA	7421	90-110	75-125CLP
Metals by GFAA	7000	90-110	75-125CLP
Metals by ICP	6010	90-110	75-125CLP

Table 2.4 - Semivariates - EPA Method 6270

MATRIX: WATER - 13572

SURROGATE COMPOUNDS - % RECOVERY										MATRIX SPIKE DATA												
FIELD	COMPOUND / SAMPLE NUMBER	DATE	DATE	SAMPLED / EXTRACTED / ANALYZED	ABZ TARGET	FBP TARGET	TPH TARGET	PHL TARGET	2FP TARGET	TBP TARGET	(%RECOVERY)	RANGE (d)	RANGE (c)	RANGE (b)	RANGE (a)	(g) RANGE	(f) RANGE	(e) RANGE	(d) RANGE	(c) RANGE	(b) RANGE	(a) RANGE
POINT	MS/ASD DATA (a)	105/26/89	05/30/89	106/06/89	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	Pheno	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	2-Chloropheno	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	1,4-Dichlorobenzene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	1-Nitroso-di-n-propylamine	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	1,2,4-Trichlorobenzene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	1,4-chloro-3-methylphenol	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	Aceanthrene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	4-Nitrophenol	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	2,4-Dinitrotoluene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	Pentachloropheno	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	Pyrene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	SAMPLE NUMBERS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
MS	13572M6	105/26/89	05/30/89	106/06/89	13	35-114	87	43-114	26	33-14	16	15-103	10	21-100	15	10-123	-	-	-	-	-	
MSD	13572B27	105/26/89	05/30/89	106/06/89	118	-	91	-	69	-	86	-	71	-	92	-	-	-	-	-	-	
R1C	13572018	105/26/89	05/30/89	106/06/89	111	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
R2C	13572014	105/26/89	05/30/89	106/06/89	112	-	89	-	48	-	99	-	85	-	101	-	-	-	-	-	-	
R3C	13572008	105/26/89	05/30/89	106/06/89	111	-	98	-	34	-	109	-	97	-	86	-	-	-	-	-	-	
R4C	13572004	105/26/89	05/30/89	106/06/89	94	-	90	-	61	-	98	-	90	-	80	-	-	-	-	-	-	
R4C-DL	13572004D	105/26/89	05/30/89	106/06/89	117	-	94	-	72	-	113	-	94	-	121	-	-	-	-	-	-	
R4C-RD	13572004D	105/26/89	05/30/89	106/06/89	D	-	D	-	D	-	D	-	D	-	D	-	-	-	-	-	-	
R5C	13572023	105/26/89	05/30/89	106/06/89	*	-	*	-	*	-	*	-	*	-	*	-	-	-	-	-	-	
RINSEBLK	*13572024	105/26/89	05/30/89	106/06/89	108	-	90	-	80	-	92	-	70	-	87	-	-	-	-	-	-	
SITE4_R	*13572020R	105/26/89	05/30/89	106/06/89	100	-	72	-	72	-	96	-	87	-	77	-	-	-	-	-	-	
SITE4_OW	13572020	105/26/89	05/30/89	106/06/89	98	-	72	-	7	-	84	-	7	-	76	-	-	-	-	-	-	
TRIPBLK	13572025	105/26/89	05/30/89	106/06/89	96	-	77	-	75	-	96	-	81	-	96	-	-	-	-	-	-	
SBLKW	W0531881	(h)	105/30/89	106/06/89	85	-	79	-	74	-	94	-	74	-	89	-	-	-	-	-	-	
SBLKW2	W0531982	(h)	105/30/89	106/06/89	99	-	102	-	106	-	94	-	87	-	116	-	-	-	-	-	-	

OOTNOTES: (a) Matrix Spike matrix Spike Duplicates (MS/MSD) samples are run every 20 samples regardless of analysis date.

(b) NBZ - Nitrobenzene

(ε) FBP = 2-f |W|g |θ|εγυ|

(d) TRH = Terphenyl

(c)  $\frac{1}{\sqrt{2}}$  (d)  $\frac{1}{\sqrt{3}}$

(e) PHL - Phenol

(1)  $2\text{Fp} = 2\text{-Fluoropheno}$

(g) TBP - 2,4,6-Tribromophenol

(h) Blank data is supplied by

Table 2.5 - Semivolatiles - EPA Method 8270

MATRIX: SOIL - 13572										MATRIX SPIKE DATA												
SURROGATE COMPOUNDS - % RECOVERY										DUPLICATE M. SPIKE DATA												
POINT	FIELD	COMPOUND / SAMPLE NUMBER	DATE SAMPLED	DATE EXTRACTED/ANALYZED	NBZ TARGET	FBP TARGET	TPH TARGET	TBP TARGET	PHL TARGET	(a)	RANGE (b)	RANGE (c)	RANGE (d)	RANGE (e)	RANGE (f)	RANGE (g)	RANGE (h)	RANGE (i)	PRECISION (% RECOVERY)	PRECISION (% REL.)	PRECISION (% DIFF.)	COMMENTS
		M5/MSD DATA (a)	05/26/89	06/05/89	106/07/89																	
		Phenol																	96	26-90	1	HIGH SPIKE RECOVERY
		2-Chlorophenol																	92	25-102	1	
		1,4-Dichlorobenzene																	83	28-104	1	
		N-Nitroso-di-n-propylamine																	99	41-126	1	
		1,2,4-Trichlorobenzene																	85	38-107	1	
		1,4-Chloro-3-methylphenol																	103	26-103	1	
		Aceanaphthene																	98	31-137	1	
		4-Nitrophenol																	110	111-114	1	
		2,4-Dinitrotoluene																	52	28-89	1	
		Pentachlorophenol																	91	17-109	1	
		Pyrene																	85	35-142	1	
		SAMPLE NUMBERS																	82	4		
	R1C_MS	13572A29	05/26/89	06/05/89	106/07/89	95	23-120	1	94	30-115	1	87	18-137	1	108	24-113	1	97	25-121	1	91	19-122
	R1C_MS	13572030	05/26/89	06/05/89	106/07/89	92			92		85		101		95				95		74	
	R1C	13572016	05/26/89	06/05/89	106/07/89	94			90		84		99		97				97		81	
	R1D	13572017	05/26/89	06/05/89	106/07/89	94			107		107		89		97				97		100	
	R1U	13572015	05/26/89	05/30/89	106/05/89	102			106		96		92		101				92		108	
	R2C	13572012	05/26/89	05/30/89	106/05/89	102			96		93		104		98				104		103	
	R2D	13572013	05/26/89	05/30/89	106/05/89	89			86		85		81		89				81		13	
	R2U	13572011	05/26/89	05/30/89	106/05/89	85			92		79		87		97				87		16	
	R3C	13572006	05/26/89	05/30/89	106/01/89	82			80		81		90		83				90		116	
	R3D	13572007	05/26/89	05/30/89	106/05/89	102			97		98		100		97				97		108	
	R3J	13572005	05/26/89	05/30/89	106/05/89	79			93		80		101		90				90		101	
	R4C	13572002	05/26/89	05/30/89	106/02/89	57			74		85		80		78				80		105	
	R4D	13572003	05/26/89	05/30/89	106/05/89	85			100		90		93		103				97		97	
	R4U	13572001	05/26/89	05/30/89	106/05/89	103			106		92		90		97				97		78	
	R5C	13572022	05/26/89	05/30/89	106/05/89	62			106		88		79		96				96		96	
	ISITE_1_CI	13572009	05/26/89	05/30/89	106/05/89	88			98		86		85		92				85		109	
	ISITE_1_AL	13572010	05/26/89	05/30/89	106/05/89	86			89		82		82		91				88		88	
	ISITE_4_OI	13572019	05/26/89	05/30/89	106/05/89	107			125		100		106		119				106		121	
	ISBLKS	S0530981	(h)	(h)	105/30/89	106/01/89	65		65		73		78		71				81		81	
	ISBLKS2	S0530981	(h)	(h)	105/30/89	106/05/89	84		80		82		83		81				90		90	
	ISBLKS4	S0530982	(h)	(h)	105/30/89	106/05/89	82		88		95		79		91				83		83	
	ISBLKS5	S0605981	(h)	(h)	106/05/89	106/07/89	91		85		91		85		84				94		94	

FOOTNOTES: (a) Matrix Spike/Matrix Spike Duplicate (MS/MSD) samples are run every 20 samples regardless of analysis date.

(b) NBZ - Nitrobenzene

(c) FBP - 2-Fluorobiphenyl

(d) TPH - Terphenyl

(e) PHL - Phenol

(f) 2FP - 2-Fluorophenol

(g) TBP - 2,4,6-Tribromophenol

(h) Blank data is supplied for each day of extraction.

Table 2.6 - Semivolatiles - EPA Method 8270

MATERIAL: SOIL • 13676										MATERIAL SPIKE DATA (DUPLICATE, M. SPIKE DATA)									
SURROGATE COMPOUNDS - % RECOVERY										TARGETS (PPM)									
FIELD	COMPOUND / SAMPLE NUMBER	DATE EXTRACTED	DATE SAMPLED	NBZ ANALYZED	NBZ TARGET	FBP TARGET	TPH TARGET	PHL TARGET	2FP TARGET	TBP TARGET	(a) RANGE	(b) RANGE	(c) RANGE	(d) RANGE	(e) RANGE	(f) RANGE	(g) RANGE	(h) RANGE	(i) RANGE
	M/S/SD DATA (a)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Phenol	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	26-90	NA	NA
	2-ChlorophenoI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	25-102	NA	NA
	1,4-Dichlorobenzene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	28-104	NA	NA
	(N-Nitroso-di-n-propylamine)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	41-126	NA	NA
	1,2,4-Trichlorobenzene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	38-107	NA	NA
	1,4-Chloro-3-methylphenol	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	26-103	NA	NA
	Aacenaphthene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	31-137	NA	NA
	4-Nitrophenol	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	11-114	NA	NA
	2,4-Dinitrotoluene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	28-89	NA	NA
	Pentachlorophenol	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	17-109	NA	NA
	Pyrene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	35-142	NA	NA
	SAMPLE NUMBERS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	M/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	M/S/D	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	1-3	13676017	106/07/89 06/13/89	106/20/89	89	88	89	89	89	89	85	85	85	85	85	85	85	99	99
1-10	13676010	106/07/89 06/13/89	106/20/89	91	90	80	80	80	80	61	90	90	90	90	90	90	90	100	100
4-1	13676009	106/07/89 06/13/89	106/20/89	91	90	78	78	78	78	90	83	83	83	83	83	83	83	91	91
8-9	13676019	106/07/89 06/13/89	106/20/89	94	84	96	96	96	96	87	82	82	82	82	82	82	82	105	105
	SBLSK	50613961	(h)	106/13/89	106/20/89	95	93	96	92	86	98	98	98	98	98	98	98	98	98

FOOTNOTES: (a) Matrix Spike/Matrix Spike Duplicates (M/S/SD) samples are run every 20 samples regardless of analysis date.  
 (b) NBZ - Nitrobenzene  
 (c) FBP - 2-Fluorobiphenyl  
 (d) TPH - Terphenyl  
 (e) PHL - Phenol  
 (f) 2FP - 2-Fluorophenol  
 (g) TBP - 2,4,6-Tribromophenol  
 (h) Blank data is supplied for each day of extraction.

Table 2.7 - Semivolatiles - EPA Method 8270

FIELD POINT	COMPOUND NUMBER	SURROGATE COMPOUNDS - % RECOVERY			MATRIX SPIKE DATA			DUPLICATE M. SPIKE DATA				
		SAMPLE NUMBER	DATE	DATE	ISAMPLED	EXTRACTED/ANALYZED	NBZ TARGET	FBP TARGET	TPH TARGET	PHL TARGET	2FP TARGET	
						(c) RANGE	(d) RANGE	(e) RANGE	(f) RANGE	(g) RANGE	(h) RANGE	(i)
	AS/MSD DATA (a)		10/16/89	10/20/89	10/26/89							
	Pheno											
	2-chlorophenol											
	1,4-Dichlorobenzene											
	1-Nitroso-di-n-propylamine											
	1,2,4-Trichlorobenzene											
	1,4-Chloro-3-methyl Phenol											
	Aceanaphthene											
	4-Nitrophenol											
	2,4-Dinitrotoluene											
	Pentachloropheno											
	Pyrene											
	SAMPLE NUMBERS											
	3E-6AS	13272008	10/16/89	10/20/89	10/26/89	115	35-114	86	43-116	82	33-14	8
	13E-6ASD	13272009	10/16/89	10/20/89	10/26/89	115	87	76	3	70	83	
	1-2	13272003	10/16/89	10/20/89	10/26/89	97	78	44	75	71		
	3E-6	13272001	10/16/89	10/20/89	10/26/89	112	85	70	(1)	69		
	4-1	13272002	10/16/89	10/20/89	10/26/89	92	78	67	83	76		
	8-1	13272004	10/16/89	10/20/89	10/26/89	10	71	44	81	72		
	EQUIP BL	13272006	10/16/89	10/20/89	10/26/89	102	83	86	83	77		
	FIELD BL	13272005	10/16/89	10/20/89	10/26/89	96	79	77	78	74		
	TRAVEL BL	13272007	10/16/89	10/20/89	10/26/89	107	85	84	80	77		
	SBLKW	W0620981	(h)	10/20/89	10/26/89	97	79	61	73	65	75	

FOOTNOTES: (a) Matrix Spike/Matrix Spike Duplicates (MS/MSD) samples are run every 20 samples regardless of analysis date.

(b) NBZ = Nitrobenzene

(c) FBP = 2,4,6-Tribromopheno

(d) TPH = Terphenyl

(e) PHL = Phenol

(f) 2FP = 2-Fluoropheno

(g) TBP = 2,4,6-Tribromopheno

(h) Blank data is supplied for each day of extraction.

(i) Value was not reported by the laboratory.

Table 2.8 - Volatile Organic Compounds - EPA Method 8024

MATRIX: WATER - 23529

SURROGATE COMPOUNDS - % RECOVERY										MATRIX SPIKE DATA			DUPLICATE W. SPIKE DATA		
FIELD	COMPOUND/	SAMPLE	DATE	ANALYZED	DB	TARGET	D4	TARGET (%RECOVERY)	ACCURACY	ACCEPTABLE	PRECISION	% REL.	IFLAG	COMMENTS	
POINT		NUMBER		(b)	RANGE	(C)	RANGE	(d)	RANGE	RANGE	(2S)	DIFF.			
	AS/NSD DATA (a)	06/15/89	06/22/89												
	1,1-Dichloroethene														
	Trichloroethylene														
	Benzene														
	Toluene														
	Chlorobenzene														
	SAMPLE NUMBERS														
3E-6	67618	06/15/89	06/22/89		101	86-110	97	86-115	100	76-114					
3E-6,R_DL	67618_R_DL	06/15/89	06/23/89		90		112			103					
METHOD BLANK	2352982	NA	06/22/89		97		97			97					
METHOD BLANK	2352981	NA	06/23/89		90		111			102					

(a) Matrix Spike/Matrix Spike Duplicates (MS/MSD) samples are run every 20 samples regardless of analysis date.

- (b) D8 - Toluene  
 (c) 1,4-B - 1,4-Bromofluorobenzene  
 (d) D4 - 1,2-Dichlorobenzene

Table 2.9 - Volatile Organic Compounds - EPA Methods 8010

MATRIX: WATER 13572

ISURROGATE COMPOUNDS - % MATRIX SPIKE DATA												
FIELD	COMPOUND/ SAMPLE NUMBER	DATE SAMPLED	DATE ANALYZED	BCM (%)	SPIKE TARGET RANGE	ACCURACY (%)	ACCEPTABLE RESULT (ppb)	PRECISION % RECOVERY (2S)	% REL.	FLAG	COMMENTS	
	MS/MSD DATA (a)	105/26/89	106/08/89									
	Chloromethane				23.1	115.5	D-193	98.5	15.9			
	Bromomethane				20.7	103.5	D-144	90.0	14.0			
	Dichlorodifluoromethane				--	--	(c)	--	--			
	Vinyl chloride				23.3	116.5	D-144	99.5	15.7			
	Chloroethane				15.3	76.5	46-137	66.0	14.7			
	Methylene chloride				19.4	97.0	25-162	87.5	10.3			
	Trichlorofluoromethane				14.1	70.5	21-156	45.5	43.1			
	1,1-Dichloroethene				17.6	88.0	28-167	73.0	18.6			
	1,1-Dichloroethane				20.2	101.0	47-132	90.0	11.5			
	trans-1,2-Dichloroethene				19.0	95.0	38-155	85.5	10.5			
	Chloroform				21.1	105.5	49-133	88.5	17.5			
	1,2-Dichloroethane				20.8	104.0	51-147	90.5	13.9			
	1,1,1-Trichloroethane				19.7	98.5	41-138	94.5	4.1			
	Carbon Tetrachloride				20.5	102.5	43-143	90.0	13.0			
	Bromodichloromethane				21.0	105.0	42-172	92.5	12.7			
	1,2-Dichloropropane				20.5	102.5	44-156	91.5	11.3			
	cis-1,3-Dichloropropene				20.8	104.0	22-178	94.0	10.1			
	Trichloroethene				20.6	103.0	35-146	90.0	13.5			
	Dibromochloromethane				20.8	104.0	24-191	93.0	11.2			
	1,1,2-Trichloroethane				20.3	101.5	39-136	93.0	8.7			
	trans-1,3-Dichloropropene				19.6	98.0	22-178	89.0	9.6			
	Bromoform				19.8	99.0	13-159	89.0	10.6			
	1,1,2,2-Tetrachloroethane				23.5	117.5	8-184	102.5	13.6			
	Tetrachloroethene				22.0	110.0	26-162	98.0	11.5			
	Chlorobenzene				22.8	114.0	38-150	101.5	11.6			
	1,3-Dichlorobenzene				27.3	136.5	7-187	115.5	16.7			
	1,2-Dichlorobenzene				25.2	126.0	D-208	114.0	10.0			
	1,4-Dichlorobenzene				25.9	129.5	42-143	114.5	12.3			
	SAMPLE											
MS	13572M27	105/26/89	06/08/89	NOT REPORTED	(c)							
MSD	13572D27	105/26/89	06/08/89	NOT REPORTED								
TRIP BLANK	13572025	105/26/89	06/08/89	131								
10-RINSE BLK	13572024	105/26/89	06/08/89	102								
RIC	13572018	105/26/89	06/08/89	142								
ISITE 4-OWS OI	13572020	105/26/89	06/08/89	98								
R5C	13572023	105/26/89	06/09/89	116								
R4C	13572004	105/26/89	06/09/89	116								
R3C	13572008	105/26/89	06/07/89	56					L	LOW SURROGATE RECOVERY		
R2C	13572014	105/26/89	06/07/89	112								
METHOD BLANK	06/08/89 (0206)	(d)	106/08/89	81								
METHOD BLANK	06/08/89 (1347)	(d)	106/08/89	107								

FOOTNOTES: (a) Matrix Spike/Matrix Spike Duplicates (MS/MSD) samples are run every 20 samples regardless of analysis date.

Acceptable ranges are listed in EPA Method 8010, Table 3, of Test Methods for Evaluating Solid Waste, SW-846 Manual, third edition.

(b) BCM - Bromochloromethane

(c) No acceptable range available

(d) Blank data is supplied for each analysis day.

Table 2.10 - Volatile Organic Compounds - EPA Methods 8010

MATRIX: SOIL 13572

SURROGATE COMPOUNDS - % IMATRIX SPIKE DATA											
FIELD	COMPOUND/	DATE	DATE	BCM	ISPIKE	ACCURACY	ACCEPTABLE	PRECISION	FLAG	COMMENTS	
SAMPLE	SAMPLE	ISAMPLED	IANALYZED	(%)RECOVERY	TARGET	IRESULT	(%)RECOVERY	RANGE	% RECOVERY	% REL.	
POINT	NUMBER			(b)	RANGE	(ppb)	(25)	DIFF.			
	MS/MSD DATA (a)	105/26/89	106/09/89								
	Chloromethane				1976	79.0	D-193	79.4	0.4		
	Bromomethane				1976	79.0	D-144	75.7	4.3		
	Dichlorodifluoromethane				--	--	(c)	--	--		
	Vinyl chloride				2192	87.7	D-144	80.9	8.0		
	Chloroethane				1514	60.6	46-137	59.0	2.5		
	Methylene chloride				2117	84.7	25-162	83.3	1.7		
	Trichlorofluoromethane				1187	47.5	21-156	39.0	19.7		
	1,1-Dichloroethene				1720	68.8	28-167	65.2	5.4		
	1,1-Dichloroethane				2091	83.6	47-132	82.7	1.2		
	trans-1,2-Dichloroethene				1974	79.0	38-155	77.7	1.6		
	Chloroform				2171	86.8	49-133	84.1	3.2		
	1,2-Dichloroethane				2156	86.2	51-147	83.3	3.5		
	1,1,1-Trichloroethane				2224	89.0	41-138	91.5	2.8		
	Carbon Tetrachloride				2165	86.6	43-143	83.6	3.6		
	Bromodichloromethane				2274	91.0	42-172	85.8	5.8		
	1,2-Dichloropropane				2236	89.4	44-156	86.0	4.0		
	cis-1,3-Dichloropropene				2240	89.6	22-178	86.2	3.8		
	Trichloroethene				2193	87.7	35-146	83.5	4.9		
	Dibromochloromethane				2160	86.4	24-191	85.4	1.1		
	1,1,2-Trichloroethane				2177	87.1	39-136	84.7	2.8		
	trans-1,3-Dichloropropene				2162	86.5	22-178	84.0	2.9		
	Bromoform				2043	81.7	13-159	80.8	1.1		
	1,1,2,2-Tetrachloroethane				2140	85.6	8-184	84.0	1.9		
	Tetrachloroethene				2368	94.7	26-162	90.7	4.4		
	Chlorobenzene				2284	91.4	38-150	90.8	0.6		
	1,3-Dichlorobenzene				2908	116.3	7-187	108.4	7.0		
	1,2-Dichlorobenzene				2465	98.6	D-208	105.5	6.8		
	1,4-Dichlorobenzene				2690	107.6	42-143	101.9	5.4		
	SAMPLE										
MS	13572#29	105/26/89	106/09/89	NOT REPORTED	(c)						
MSD	13572D30	105/26/89	106/09/89	NOT REPORTED							
R1U	13572015	105/26/89	106/07/89	97							
R1C	13572016	105/26/89	106/07/89	133							
R1D	13572017	105/26/89	106/07/89	133							
ISITE 4 OWS 01	13572019	105/26/89	106/07/89	98							
R5D	13572021	105/26/89	106/07/89	136							
R5C	13572022	105/26/89	106/07/89	145							
R4U	13572001	105/26/89	106/07/89	131							
R4C	13572002	105/26/89	106/07/89	146							
R4D	13572003	105/26/89	106/07/89	98							
R3U	13572005	105/26/89	106/07/89	141							
R3C	13572006	105/26/89	106/07/89	133							
R3D	13572007	105/26/89	106/07/89	133							
ISITE 1-CREEK1	13572019	105/26/89	106/07/89	103							
ISITE 1-CREEK1	13572020	105/26/89	106/07/89	136							
R2U	13572011	105/26/89	106/08/89	136							
R2C	13572012	105/26/89	106/08/89	135							
R2D	13572013	105/26/89	106/08/89	142							
IMETHOD BLANK1	06/07/89 (0039)	(d)	106/07/89	136							
IMETHOD BLANK1	06/07/89 (1346)	(d)	106/07/89	99							
IMETHOD BLANK1	06/08/89 (0206)	(d)	106/08/89	81							

FOOTNOTES: (a) Matrix Spike/Matrix Spike Duplicates (MS/MSD) samples are run every 20 samples regardless of analysis date.

Acceptable ranges are listed in EPA Method 8010, Table 3, of Test Methods for Evaluating Solid Waste, SW-846 Manual, third edition.

(b) BCM - Bromochloromethane

(c) No acceptable range available

(d) Blank data is supplied for each analysis day.

Table 2.11 - Volatile Organic Compounds - EPA Methods 8010

MATRIX: WATER 13701, 13726

ISURROGATE COMPOUNDS - % MATRIX SPIKE DATA												
FIELD	COMPOUND/ SAMPLE	DATE SAMPLED	DATE ANALYZED	BCM (%) (b)	TARGET RANGE	SPIKE (ppb)	ACCURACY RESULT (%) (%RECOVERY)	ACCEPTABLE RANGE (25)	% RECOVERY % REL.	PRECISION DIFF.	FLAG	COMMENTS
	MS/MSD DATA (a)	106/13/89	106/28/89									
	Chloromethane					19.1	95.5	D-193	95.5	0.0		
	Bromomethane					23.0	115.0	D-144	112.0	2.6		
	Dichlorodifluoromethane					23.6	118.0	(c)	95.5	21.1		
	Vinyl chloride					17.8	89.0	D-144	92.0	3.3		
	Chloroethane					6.9	34.5	46-137	39.5	13.5	L	LOW SPIKE RECOVERY
	Methylene chloride					21.9	109.5	25-162	112.5	2.7		
	Trichlorofluoromethane					25.7	128.5	21-156	105.5	19.7		
	1,1-Dichloroethene					22.4	112.0	28-167	101.5	9.8		
	1,1-Dichloroethane					21.9	109.5	47-132	112.5	2.7		
	trans-1,2-Dichloroethene					22.1	110.5	38-155	111.5	0.9		
	Chloroform					21.7	108.5	49-133	112.0	3.2		
	1,2-Dichloroethane					21.4	107.0	51-147	109.5	2.3		
	1,1,1-Trichloroethane					21.7	108.5	41-138	122.0	11.7		
	Carbon Tetrachloride					22.6	113.0	43-143	103.5	8.8		
	Bromodichloromethane					22.2	111.0	42-172	99.0	11.4		
	1,2-Dichloropropane					18.9	94.5	44-156	94.5	0.0		
	cis-1,3-Dichloropropene					21.3	106.5	22-178	100.0	6.3		
	Trichloroethene					21.6	108.0	35-146	107.5	0.5		
	Dibromochloromethane					21.4	107.0	24-191	98.0	8.8		
	1,1,2-Trichloroethane					20.4	102.0	39-136	104.5	2.4		
	trans-1,3-Dichloropropene					21.2	106.0	22-178	100.0	5.8		
	Bromoform					21.9	109.5	13-159	103.0	6.1		
	1,1,2,2-Tetrachloroethane					19.7	98.5	8-184	100.0	1.5		
	Tetrachloroethene					21.5	107.5	26-162	102.5	4.8		
	Chlorobenzene					20.1	100.5	38-150	100.0	0.5		
	1,3-Dichlorobenzene					19.4	97.0	7-187	93.0	4.2		
	1,2-Dichlorobenzene					18.3	91.5	D-208	90.5	1.1		
	1,4-Dichlorobenzene					19.6	98.0	42-143	94.0	4.2		
	SAMPLE											
MS	2-GW-WP10 MS	106/13/89	106/28/89	NOT REPORTED	(c)							
MSD	2-GW-WP10 MSD	106/13/89	106/28/89	NOT REPORTED								
TRAVEL BLANK	13701020/23513-1	106/13/89	106/25/89		106							
2-GW-WP1	23513-2	106/13/89	106/27/89		104							
2-GW-WP2	23513-3	106/13/89	106/27/89		102							
3E-GW-WP6	13726001	106/15/89	106/27/89		100							
1-GW-WP1A	13726005	106/15/89	106/27/89		111							
2-GW-WP6	13726016	106/15/89	106/27/89		108							
2-GW-WP9	13726017	106/15/89	106/27/89		108							
2-GW-WP10	13726018	106/15/89	106/27/89		109							
FIELD BLANK	13726019	106/15/89	106/27/89		108							
EQUIP. BLANK	13726020	106/15/89	106/27/89		96							
TRAVEL BLANK	13726021	106/15/89	106/27/89		110							
METHOD BLANK	06/25/89 (1856)	(d)	106/25/89		108							
METHOD BLANK	06/27/89 (1549)	(d)	106/27/89		114							
METHOD BLANK	06/27/89 (0354)	(d)	106/27/89		109							

FOOTNOTES: (a) Matrix Spike/Matrix Spike Duplicates (MS/MSD) samples are run every 20 samples regardless of analysis date.

Acceptable ranges are listed in EPA Method 8010, Table 3, of Test Methods for Evaluating Solid Waste, SW-846 Manual, third edition.

(b) BCM - Bromochloromethane

(c) No acceptable range available

(d) Blank data is supplied for each analysis day.

MATRIX: SOIL 13676

Table 2.11 (continued) - Volatile Organic Compounds - EPA Methods 8010

FIELD SAMPLE POINT	COMPOUND/ SAMPLE NUMBER	DATE SAMPLED	DATE ANALYZED	BCM (b)	TARGET RANGE	ISURROGATE COMPOUNDS - % MATRIX SPIKE DATA			PRECISION (2S)	IFLAG	COMMENTS
						SPIKE RESULT (ppb)	ACCURACY (%RECOVERY)	ACCEPTABLE RANGE (2S)			
	MS/MSD DATA (a)	06/07/89	06/15/89								
	Chloromethane				2000	80.0	D-193	84.0	4.9		
	Bromomethane				1600	64.0	D-144	76.0	17.1		
	Dichlorodifluoromethane				2100	84.0	(c)	80.0	4.9		
	Vinyl chloride				1800	72.0	D-144	80.0	10.5		
	Chloroethane				550	22.0	46-137	39.6	57.1	L	LOW SPIKE RECOVERY
	Methylene chloride				3600	144.0	25-162	148.0	2.7		
	Trichlorofluoromethane				1900	76.0	21-156	80.0	5.1		
	1,1-Dichlorethane				2800	112.0	28-167	92.0	19.6		
	1,1-Dichloroethane				2500	100.0	47-132	100.0	0.0		
	trans-1,2-Dichloroethene				2300	92.0	38-155	92.0	0.0		
	Chloroform				2100	84.0	49-133	84.0	0.0		
	1,2-Dichloroethane				4400	176.0	51-147	172.0	2.3	K	HIGH SPIKE RECOVERY
	1,1,1-Trichloroethane				2500	100.0	41-138	100.0	0.0		
	Carbon Tetrachloride				2200	88.0	43-143	88.0	0.0		
	Bromodichloromethane				2300	92.0	42-172	92.0	0.0		
	1,2-Dichloropropane				2200	88.0	44-156	88.0	0.0		
	cis-1,3-Dichloropropene				2300	92.0	22-178	88.0	4.4		
	Trichloroethene				2200	88.0	35-146	108.0	20.4		
	Dibromochloromethane				1900	76.0	24-191	72.0	5.4		
	1,1,2-Trichloroethane				2700	108.0	39-136	104.0	3.8		
	trans-1,3-Dichloropropene				2200	88.0	22-178	84.0	4.7		
	Bromoform				2100	84.0	13-159	80.0	4.9		
	1,1,2,2-Tetrachloroethane				2600	104.0	8-184	100.0	3.9		
	Tetrachloroethene				2400	96.0	26-162	96.0	0.0		
	Chlorobenzene				2300	92.0	38-150	96.0	4.3		
	1,3-Dichlorobenzene				2300	92.0	7-187	96.0	4.3		
	1,2-Dichlorobenzene				2300	92.0	D-208	96.0	4.3		
	1,4-Dichlorobenzene				2200	88.0	42-143	92.0	4.4		
	SAMPLE										
MS	13676M28	06/07/89	06/15/89	NOT REPORTED	(c)						
MSD	13676D29	06/07/89	06/15/89	NOT REPORTED							
13E-SL-WP6-1	13676001	06/07/89	06/13/89	114							
13E-SL-WP6-2	13676002	06/07/89	06/13/89	106							
13E-SL-WP7-1	13676003	06/07/89	06/13/89	107							
13E-SL-WP1-1	13676004	06/07/89	06/13/89	100							
13W-SL-WP1-1	13676005	06/07/89	06/13/89	101							
13W-SL-WP5-1	13676006	06/07/89	06/13/89	89							
17-SL-WP2-1	13676007	06/07/89	06/13/89	93							
17-SL-WP5-1	13676008	06/07/89	06/14/89	97							
14-SL-WP1-1	13676009	06/07/89	06/14/89	89							
14-SL-WP10-1	13676010	06/07/89	06/14/89	86							
14-SL-WP1-2	13676011	06/07/89	06/14/89	86							
14-SL-WP2-1	13676012	06/07/89	06/14/89	87							
14-SL-WP3-1	13676013	06/07/89	06/14/89	79							
1-SL-WP1-1	13676014	06/07/89	06/14/89	92							
11-SL-WP10-1	13676015	06/07/89	06/14/89	85							
1-SL-WP2-1	13676016	06/07/89	06/14/89	83							
1-SL-WP3-1	13676017	06/07/89	06/14/89	81							
1-SL-WP4-1	13676018	06/07/89	06/14/89	83							
8-SL-WP1-1	13676019	06/07/89	06/15/89	80							
8-SL-WP3-1	13676020	06/07/89	06/14/89	80							
8-SL-WP4-1	13676021	06/07/89	06/15/89	82							
18-SL-WP10-1	13676022	06/07/89	06/17/89	124							
(METHOD BLANK)	06/13/89 (0402)	(d)	06/13/89	99							
(METHOD BLK (e))	06/13/89 (1211)	(d)	06/13/89	92							
(METHOD BLANK)	06/13/89 (2227)	(d)	06/13/89	77							
(METHOD BLANK)	06/14/89 (0903)	(d)	06/14/89	80							
(METHOD BLANK)	06/15/89 (0409)	(d)	06/15/89	72							
(METHOD BLANK)	06/17/89 (1856)	(d)	06/17/89	100							
(METHOD BLANK)	06/18/89 (1222)	(d)	06/18/89	104							

FOOTNOTES: (a) Matrix Spike/Matrix Spike Duplicates (MS/MSD) samples are run every 20 samples regardless of analysis date.  
Acceptable ranges are listed in EPA Method 8010, Table 3, of Test Methods for Evaluating Solid Waste, SW-846 Manual, third edition.

- (b) BCM - Bromochloromethane
- (c) No acceptable range available
- (d) Blank data is supplied for each analysis day.
- (e) Method blank used to demonstrate methanol solvent purity.

Table 2.12 - Volatile Organic Compounds - EPA Methods 8010

MATRIX: SOIL 13676

SURROGATE COMPOUNDS - % / MATRIX SPIKE DATA												
FIELD	COMPOUND/ SAMPLE	DATE SAMPLED	DATE ANALYZED	BCM (%)RECOVERY	TARGET RANGE	SPIKE (ppb)	ACCURACY (%)RECOVERY	ACCEPTABLE	PRECISION RANGE (2S)	% RECOVERY % REL.	FLAG DIFF.	COMMENTS
POINT	NUMBER			(b)								
	MS/MSD DATA (a)	106/07/89	106/15/89									
	Chloromethane					1800	72.0	D-193	92.0	24.4		
	Bromomethane					1800	72.0	D-144	80.0	10.5		
	Dichlorodifluoromethane					2300	92.0	(c)	100.0	8.3		
	Vinyl chloride					1900	76.0	D-144	80.0	5.1		
	Chloroethane					560	22.4	46-137	24.0	6.9	L	LOW SPIKE RECOVERY
	Methylene chloride					3900	156.0	25-162	160.0	2.5		
	Trichlorofluoromethane					2100	84.0	21-156	92.0	9.1		
	1,1-Dichloroethene					2300	92.0	28-167	92.0	0.0		
	1,1-Dichloroethane					2600	104.0	47-132	108.0	3.8		
	trans-1,2-Dichloroethene					2400	96.0	38-155	100.0	4.1		
	Chloroform					2200	88.0	49-133	92.0	4.4		
	1,2-Dichloroethane					2600	104.0	51-147	108.0	3.8		
	1,1,1-Trichloroethane					2600	104.0	41-138	108.0	3.8		
	Carbon Tetrachloride					2200	88.0	43-143	96.0	8.7		
	Bromodichloromethane					2400	96.0	42-172	96.0	0.0		
	1,2-Dichloropropane					2300	92.0	44-156	92.0	0.0		
	cis-1,3-Dichloropropene					2300	92.0	22-178	92.0	0.0		
	Trichloroethene					2800	112.0	35-146	112.0	0.0		
	Dibromochloromethane					2200	88.0	24-191	96.0	8.7		
	1,1,2-Trichloroethane					2800	112.0	39-136	116.0	3.5		
	trans-1,3-Dichloropropene					2100	84.0	22-178	88.0	4.7		
	Bromoform					2100	84.0	13-159	88.0	4.7		
	1,1,2,2-Tetrachloroethane					2700	108.0	8-184	108.0	0.0		
	Tetrachloroethene					2500	100.0	26-162	104.0	3.9		
	Chlorobenzene					2500	100.0	38-150	100.0	0.0		
	1,3-Dichlorobenzene					2500	100.0	7-187	100.0	0.0		
	1,2-Dichlorobenzene					2400	96.0	D-208	96.0	0.0		
	1,4-Dichlorobenzene					2400	96.0	42-143	96.0	0.0		
	SAMPLE											
5-3 MS	5-SL-WP3-1 MS	106/07/89	106/15/89	NOT REPORTED	(c)							
5-3 MSD	5-SL-WP3-1 MSD	106/07/89	106/15/89	NOT REPORTED								
5-SL-WP3-1	13676023	106/07/89	106/15/89	85								
5-SL-WP3-2	13676024	106/07/89	106/15/89	83								
5-SL-WP2-1	13676025	106/07/89	106/15/89	77								
6-SL-WP1-1	13676026	106/07/89	106/17/89	118								
6-SL-WP2-1	13676027	106/07/89	106/15/89	88								
METHOD BLANK	06/15/89 (0409)	(d)	106/15/89	72								
METHOD BLANK	06/17/89 (1856)	(d)	106/17/89	100								

FOOTNOTES: (a) Matrix Spike/Matrix Spike Duplicates (MS/MSD) samples are run every 20 samples regardless of analysis date.

Acceptable ranges are listed in EPA Method 8010, Table 3, of Test Methods for Evaluating Solid Waste, SW-846 Manual, third edition.

(b) BCM = Bromochloromethane

(c) No acceptable range available

(d) Blank data is supplied for each analysis day.

Table 2.13 - volatile organic Compounds - EPA Methods 8010

MATRIX: WATER 23446

SURROGATE COMPOUNDS - % MATRIX SPIKE DATA												
FIELD	COMPOUND/	DATE	DATE	BCM	ISPIKE	ACCURACY	ACCEPTABLE	PRECISION				
SAMPLE	SAMPLE	ISAMPLED	IANALYZED	(%)RECOVERY	TARGET	IRESULT	(%)RECOVERY	RANGE	% RECOVERY	% REL.	IFLAG	COMMENTS
POINT	NUMBER			(b)	RANGE	(ppb)		(2S)		DIFF.		
	MS/MSD DATA (a)	106/08/89	106/23/89									
	Chloromethane				16.3	81.5	D-193	78.0	4.4			
	Bromomethane				53.3	266.5	D-144	259.5	2.7	K		
	Dichlorodifluoromethane				27.4	137.0	(c)	121.5	12.0	K		
	Vinyl chloride				16.0	80.0	D-144	75.0	6.5			
	Chloroethane				18.8	94.0	46-137	92.5	1.6			
	Methylene chloride				32.9	164.5	25-162	153.0	7.2	K		
	Trichlorofluoromethane				14.3	71.5	21-156	78.5	9.3			
	1,1-Dichloroethene				25.4	127.0	28-167	113.0	11.7			
	1,1-Dichloroethane				18.7	93.5	47-132	89.5	4.4			
	trans-1,2-Dichloroethene				23.5	117.5	38-155	101.0	15.1			
	Chloroform				17.5	87.5	49-133	88.5	1.1			
	1,2-Dichloroethane				35.4	177.0	51-147	172.5	2.6	K		
	1,1,1-Trichloroethane				22.2	111.0	41-138	110.0	0.9			
	Carbon Tetrachloride				16.9	84.5	43-143	43.0	65.1	J		
	Bromodichloromethane				17.7	88.5	42-172	38.5	78.7	J		
	1,2-Dichloropropane				16.9	84.5	44-156	82.0	3.0			
	cis-1,3-Dichloropropene				16.7	83.5	22-178	72.5	14.1			
	Trichloroethene				25.1	125.5	35-146	97.5	25.1			
	Dibromochloromethane				18.8	94.0	24-191	27.0	110.7	L		
	1,1,2-Trichloroethane				21.1	105.5	39-136	103.5	1.9			
	trans-1,3-Dichloropropene				17.1	85.5	22-178	78.0	9.2			
	Bromoform				21.8	109.0	13-159	14.5	153.0	L		
	1,1,2,2-Tetrachloroethane				24.4	122.0	8-184	109.0	11.3			
	Tetrachloroethene				23.0	115.0	26-162	87.5	27.2			
	Chlorobenzene				23.4	117.0	38-150	102.0	13.7			
	1,3-Dichlorobenzene				24.7	123.5	7-187	95.0	26.1			
	1,2-Dichlorobenzene				24.2	121.0	D-208	97.0	22.0			
	1,4-Dichlorobenzene				24.7	123.5	42-143	94.5	26.6			
	SAMPLE											
MS	MS	106/08/89	106/23/89	NOT REPORTED								
MSD	MSD	106/08/89	106/23/89	NOT REPORTED								
1-GW-WP3	23446025	106/08/89	106/21/89	92								
1-GW-WP4	23446026	106/08/89	106/23/89	97								
1-GW-WP5	23446027	106/08/89	106/21/89	94								
1-GW-WP6	23446028	106/08/89	106/21/89	101								
8-GW-WP1	23446029	106/08/89	106/22/89	110								
8-GW-WP2	23446030	106/08/89	106/22/89	121								
8-GW-WP3	23446031	106/08/89	106/22/89	113								
8-GW-WP4	23446032	106/08/89	106/22/89	132								
8-GW-WP10	23446033	106/08/89	106/22/89	97								
6-GW-WP1	23446034	106/08/89	106/22/89	81								
6-GW-WP2	23446035	106/08/89	106/22/89	94								
6-GW-WP3	23446036	106/08/89	106/22/89	92								
5-GW-WP1	23446037	106/08/89	106/22/89	91								
5-GW-WP2	23446038	106/08/89	106/22/89	96								
5-GW-WP3	23446039	106/08/89	106/22/89	91								
FIELD BLANK	23446040	106/08/89	106/22/89	92								
EQUIP. BLANK	23446041	106/08/89	106/22/89	96								
TRAVEL BLANK	23446042	106/08/89	106/22/89	94								
IMETHOD BLANK	06/17/89 (1856)	(d)	106/17/89	100								
IMETHOD BLANK	06/20/89 (0908)	(d)	106/20/89	104								
IMETHOD BLANK	06/21/89 (0316)	(d)	106/21/89	99								
IMETHOD BLANK	06/21/89 (1513)	(d)	106/21/89	99								
IMETHOD BLANK	06/22/89 (1120)	(d)	106/22/89	98								
IMETHOD BLANK	06/22/89 (1450)	(d)	106/22/89	92								
IMETHOD BLANK	06/22/89 (0340)	(d)	106/22/89	99								

FOOTNOTES: (a) Matrix Spike/Matrix Spike Duplicates (MS/MSD) samples are run every 20 samples regardless of analysis date.

Acceptable ranges are listed in EPA Method 8010, Table 3, of Test methods for Evaluating Solid Waste, SW-846 Manual, third edition.

(b) BCM - Bromochloromethane

(c) No acceptable range available

(d) Blank data is supplied for each analysis day.

Table 2.13 (continued) - Volatile Organic Compounds - EPA Methods 8010

MATRIX: WATER 23466

ISURROGATE COMPOUNDS - % MATRIX SPIKE DATA													
FIELD	COMPOUND/ SAMPLE NUMBER	DATE ISAMPLED	DATE IANALYZED	BCM (b)	%RECOVERY	TARGET RANGE	ISPIKE (ppb)	ACCURACY RESULT (%RECOVERY)	ACCEPTABLE (2S)	RANGE	% RECOVERY % REL.	PRECISION! IFLAG!	COMMENTS
	MS/MSD DATA (a)	106/08/89	106/23/89										
	Chloromethane						17.8	89.0	D-193	92.0	3.3		
	Bromomethane						49.8	249.0	D-144	254.5	2.2	K	
	Dichlorodifluoromethane						24.5	122.5	(c)	123.0	0.4		
	Vinyl chloride						15.1	75.5	D-144	65.0	14.9		
	Chloroethane						17.8	89.0	46-137	92.0	3.3		
	Methylene chloride						29.1	145.5	25-162	162.0	10.7		
	Trichlorofluoromethane						16.5	82.5	21-156	94.5	13.6		
	1,1-Dichloroethene						23.2	116.0	28-167	104.5	10.4		
	1,1-Dichloroethane						32.8	164.0	47-132	170.5	3.9		
	trans-1,2-Dichloroethene						21.1	105.5	38-155	104.5	1.0		
	Chloroform						16.3	81.5	49-133	96.0	16.3		
	1,2-Dichloroethane						32.8	164.0	51-147	170.5	3.9	K	
	1,1,1-Trichloroethane						21.5	107.5	41-138	108.0	0.5		
	Carbon Tetrachloride						15.6	78.0	43-143	7.0	167.1	L	
	Bromodichloromethane						16.6	83.0	42-172	6.5	170.9	L	
	1,2-Dichloropropane						15.4	77.0	44-156	80.0	3.8		
	cis-1,3-Dichloropropene						15.3	76.5	22-178	19.0	120.4	L	
	Trichloroethene						19.1	95.5	35-146	87.5	8.7		
	Dibromochloromethane						17.7	88.5	24-191	5.0	178.6	L	
	1,1,2-Trichloroethane						19.3	96.5	39-136	94.5	2.1		
	trans-1,3-Dichloropropene						15.3	76.5	22-178	32.0	82.0		
	Bromoform						20.8	104.0	13-159	5.0	181.7	L	
	1,1,2,2-Tetrachloroethane						21.9	109.5	8-184	110.5	0.9		
	Tetrachloroethene						19.1	95.5	26-162	87.5	8.7		
	Chlorobenzene						20.3	101.5	38-150	93.0	8.7		
	1,3-Dichlorobenzene						20.6	103.0	7-187	95.0	8.1		
	1,2-Dichlorobenzene						20.8	104.0	D-208	95.5	8.5		
	1,4-Dichlorobenzene						20.6	103.0	42-143	96.0	7.0		
	SAMPLE												
3E-GW-WP1	23446001	106/08/89	106/17/89	106									
3E-GW-WP2	23446002	106/08/89	106/17/89	108									
3E-GW-WP3	23446003	106/08/89	106/18/89	105									
3E-GW-WP4	23446004	106/08/89	106/18/89	106									
3E-GW-WP5	23446005	106/08/89	106/18/89	105									
3E-GW-WP7	23446006	106/08/89	106/18/89	105									
3E-GW-WP8	23446007	106/08/89	106/18/89	103									
3E-GW-WP9	23446008	106/08/89	106/20/89	97									
3E-GW-WP10	23446009	106/08/89	106/20/89	97									
3W-GW-WP1	23446010	106/08/89	106/20/89	99									
3W-GW-WP2	23446011	106/08/89	106/20/89	99									
3W-GW-WP3	23446012	106/08/89	106/20/89	103									
3W-GW-WP4	23446013	106/08/89	106/20/89	99									
7-GW-WP1	23446014	106/08/89	106/20/89	102									
7-GW-WP3	23446015	106/08/89	106/21/89	100									
7-GW-WP4	23446016	106/08/89	106/21/89	102									
7-GW-WP6	23446017	106/08/89	106/21/89	103									
7-GW-WP7	23446018	106/08/89	106/21/89	98									
4-GW-WP1	23446019	106/08/89	106/21/89	101									
4-GW-WP2	23446020	106/08/89	106/21/89	98									
4-GW-WP3	23446021	106/08/89	106/22/89	108									
4-GW-WP10	23446022	106/08/89	106/21/89	94									
1-GW-WP2	23446023	106/08/89	106/21/89	97									
1-GW-WP10	23446024	106/08/89	106/21/89	98									

FOOTNOTES: (a) Matrix Spike/Matrix Spike Duplicates (MS/MSD) samples are run every 20 samples regardless of analysis date.

Acceptable ranges are listed in EPA Method 8010, Table 3, of Test Methods for Evaluating Solid Waste, SW-846 Manual, third edition.

(b) BCM - Bromochloromethane

(c) No acceptable range available

(d) Blank data is supplied for each analysis day.

MATRIX: WATER - 13572

Table 2.14 - Volatile organic Compounds - EPA Methods 8020

		SURROGATE COMPOUNDS/MATRIX SPIKE DATA			DUPLICATE MATRIX SPIKE DATA						
FIELD	COMPOUND/	DATE	DATE	TFT	SPIKE	ACCURACY	ACCEPTABLE	SPIKE	PRECISION		
SAMPLE	SAMPLE	ISAMPLED	I ANALYZED	(%)RECOVERY	TARGET	RESULT (%)RECOVERY	RANGE	RESULT (%)RECOVERY	% REL.	IFLAG	COMMENTS
POINT	NUMBER			(b)	RANGE	(ppb)		(25)	(ppb)	DIFF.	
	MS/MSD DATA (a)	105/26/89	06/10/89								
	Tert Butyl Methyl Ether				20.7	103.5	(c)	22.1	110.5	6.54	
	Benzene				12.8	64.0	39-150	10.7	53.5	17.87	
	Toluene				10.8	54.0	46-148	9.9	49.5	8.70	
	Ethyl benzene				11.9	59.5	32-160	12.7	63.5	6.50	
	Xylene				12.1	60.5	(c)	13.4	67.0	10.20	
	Chlorobenzene				23.4	117.0	55-135	28.8	144.0	20.69	
	1,4-Dichlorobenzene				4.5	22.5	42-143	8	40.0	56.00	L LOW SPIKE RECOVERY
	1,3-Dichlorobenzene				(e)	NA	50-141	(e)	NA	NA	
	1,2-Dichlorobenzene				(e)	NA	37-154	(e)	NA	NA	
	SAMPLE										
MS	13572M26	105/26/89	06/10/89	NOT REPORTED	(c)						
MSD	13572D27	105/26/89	06/10/89	NOT REPORTED							
TRIP BLANK	13572025	105/26/89	06/06/89	120							
10-RINSE BLK	13572024	105/26/89	06/06/89	118							
R1C	13572018	105/26/89	06/06/89	118							
ISITE 4-OWS OI	13572020	105/26/89	06/06/89	110							
R5C	13572023	105/26/89	06/09/87	123							
R4C	13572004	105/26/89	06/09/87	112							
R3C	13572008	105/26/89	06/08/89	127							
R2C	13572014	105/26/89	06/08/89	103							
METHOD BLANK	06/06/89 (1935)	(d)	06/06/89	119							TOLUENE @ 1 PPB
METHOD BLANK	06/08/89 (2727)	(d)	06/08/89	119							
METHOD BLANK	06/08/89 (1024)	(d)	06/08/89	110							

FOOTNOTES: (a) Matrix Spike/Matrix Spike Duplicates (MS/MSD) samples are run every 20 samples regardless of analysis date.

Acceptable ranges are listed in EPA Method 8020, Table 3. of Test Methods for Evaluating Solid Waste, SW-846 Manual, third edition

(b) TFT - Trifluorotoluene

(c) No acceptable range available

(d) Blank data is supplied for each analysis day.

(e) Not resolved by this method, results reported with 601 analysis.

Table 2.15 - Volatile Organic Compounds - EPA Methods 8020

MATRIX: SOIL - 13572

		ISURROGATE COMPOUNDS/MATRIX SPIKE DATA			IDUPLICATE MATRIX SPIKE DATA								
FIELD	COMPOUND/	DATE	DATE	TFT	ISPIKE	ACCURACY	ACCEPTABLE	ISPIKE	PRECISION				
SAMPLE	SAMPLE	SAMPLED	ANALYZED	(%RECOVERY)	TARGET	IRESULT	(%RECOVERY)	RANGE	IRESULT	% RECOVERY	% REL.	IFLAG	COMMENTS
POINT	NUMBER			(b)	RANGE	(ppb)		(2S)	(ppb)		DIFF.		
	MS/MSD DATA (a)	105/26/89	106/10/89										
	Tert Butyl Methyl Ether				2800	112	(C)	2600	104	7.4			
	Benzene				3000	120	39-150	2800	112	6.9			
	Toluene				3100	124	46-148	2600	104	17.5			
	Ethyl benzene				3000	120	32-160	2600	104	14.3			
	Xylene				2500	100	(C)	2300	92	8.3			
	Chlorobenzene				7700	103	55-135	7600	101	1.3			
	1,4-Dichlorobenzene				1800	72	42-143	1800	72	0.0			
	1,3-Dichlorobenzene				(e)	NA	50-141	(e)	NA	NA	NA		
	1,2-Dichlorobenzene				(e)	NA	37-154	(e)	NA	NA	NA		
	SAMPLE												
MS	13572M29	105/26/89	106/10/89	NOT REPORTED	(C)								
MSD	13572D30	105/26/89	106/10/89	NOT REPORTED									
R1U	13572015	105/26/89	106/07/89	93									
R1C	13572016	105/26/89	106/07/89	110									
R1D	13572017	105/26/89	106/07/89	112									
ISITE 4 OWS O1	13572019	105/26/89	106/07/89	121									
R5D	13572021	105/26/89	106/07/89	114									
R5C	13572022	105/26/89	106/09/89	119									
R4U	13572001	105/26/89	106/09/89	131									
R4C	13572002	105/26/89	106/08/89	155						K	HIGH SURROGATE REC		
R4D	13572003	105/26/89	106/08/89	130									
R3U	13572005	105/26/89	106/08/89	118									
R3C	13572006	105/26/89	106/08/89	117									
R3D	13572007	105/26/89	106/08/89	64									
ISITE 1-CREEK1	13572019	105/26/89	106/08/89	112									
ISITE 1-CREEK1	13572020	105/26/89	106/08/89	76									
R2U	13572011	105/26/89	106/08/89	85									
R2C	13572012	105/26/89	106/08/89	98									
R2D	13572013	105/26/89	106/08/89	128									
METHOD BLANK	06/07/89 (1254)	(d)	106/07/89	85									
METHOD BLANK	06/07/89 (2240)	(d)	106/07/89	117									
METHOD BLANK	06/08/89 (2227)	(d)	106/08/89	119									
METHOD BLANK	06/08/89 (1024)	(d)	106/08/89	110									
METHOD BLANK	06/09/89 (0935)	(d)	106/09/89	115									

FOOTNOTES: (a) Matrix Spike/Matrix Spike Duplicates (MS/MSD) samples are run every 20 samples regardless of analysis date.

Acceptable ranges are listed in EPA Method 8020, Table 3, of Test Methods for Evaluating Solid Waste, SW-846 Manual, third edition

(b) TFT - Trifluorotoluene

(c) No acceptable range available

(d) Blank data is supplied for each analysis day.

(e) Not resolved by this method, results reported with 601 analysis.

Table 2.16 - Volatile Organic Compounds - EPA Methods 8020

MATRIX: WATER - 13701, 13726

FIELD	COMPOUND/ SAMPLE	SURROGATE COMPOUNDS			MATRIX SPIKE DATA			DUPLICATE MATRIX SPIKE DATA			PRECISION	FLAG	COMMENTS
		DATE SAMPLE	DATE ANALYZED	TFT (a)	SPIKE TARGET	ACCURACY RESULT (%)	ACCEPTABLE RANGE	SPIKE RESULT (%)	PRECISION	% RECOVERY			
					RANGE (ppb)	(2S)	(ppb)	(ppb)	DIFF.	% REL.			
	MS/MSD DATA (a)	06/13/89	06/28/89										
	Tert Butyl Methyl Ether				30.9	154.5	(c)	3.8	19.0	156.20	J,L,	LOW RECOVERY & %RSD	
	Benzene				24.3	121.5	39-150	20.3	101.5	17.94			
	Toluene				25.0	125.0	46-148	19.1	95.5	26.76			
	Ethyl benzene				26.2	131.0	32-160	15.1	75.5	53.75	M	POOR PRECISION	
	m- and p-Xylenes				48.0	120.0	(c)	40.0	100.0	18.18			
	o-Xylene				23.7	118.5	(c)	16.9	84.5	33.50	M	POOR PRECISION	
	Chlorobenzene				23.3	116.5	55-135	20.4	102.0	13.27			
	1,4-Dichlorobenzene				24.7	123.5	42-143	18.9	94.5	26.61			
	1,3-Dichlorobenzene				24.7	123.5	50-141	18.9	94.5	26.61			
	1,2-Dichlorobenzene				24.2	121.0	37-154	19.4	97.0	22.02			
	SAMPLE												
MS	13726M22	06/13/89	06/28/89	NOT REPORTED	(c)								
MSD	13726D23	06/13/89	06/28/89	NOT REPORTED									
TRAVEL BLANK	13701020/23513-1	06/13/89	06/25/89	119									
2-GW-WP1	23513-2	06/13/89	06/27/89	109									
2-GW-WP2	23513-3	06/13/89	06/27/89	96									
3E-GW-WP6	13726001	06/15/89	06/27/89	98									
1-GW-WP1A	13726005	06/15/89	06/27/89	96									
2-GW-WP6	13726016	06/15/89	06/27/89	96									
2-GW-WP9	13726017	06/15/89	06/27/89	95									
2-GW-WP10	13726018	06/15/89	06/27/89	97									
FIELD BLANK	13726019	06/15/89	06/27/89	96									
EQUIP. BLANK	13726020	06/15/89	06/27/89	96									
TRAVEL BLANK	13726021	06/15/89	06/27/89	96									
METHOD BLANK	06/25/89 (1856)	(d)	106/25/89	119									
METHOD BLANK	06/27/89 (1549)	(d)	106/27/89	96									
METHOD BLANK	06/27/89 (0354)	(d)	106/27/89	96									

FOOTNOTES: (a) Matrix Spike/Matrix Spike Duplicates (MS/MSD) samples are run every 20 samples regardless of analysis date.

Acceptable ranges are listed in EPA Method 8020, Table 3, of Test Methods for Evaluating Solid Waste, SW-846 Manual, third edition

(b) TFT - Trifluorotoluene

(c) No acceptable range available

(d) Blank data is supplied for each analysis day.

(e) Not resolved by this method, results reported with 601 analysis.

Table 2.17 - Volatile Organic Compounds - EPA Methods 8020

MATRIX: SOIL - 13676

ISURROGATE COMPOUNDS/MATRIX SPIKE DATA												IDUPLICATE MATRIX SPIKE DATA			
FIELD	COMPOUND/	DATE	DATE	TFT	SPIKE	ACCURACY	ACCEPTABLE	SPIKE	PRECISION						
SAMPLE	SAMPLE	SAMPLED	ANALYZED	(%)RECOVERY	TARGET	RESULT (%)RECOVERY	RANGE	RESULT (%)RECOVERY	% REL.	IFLAG	COMMENTS				
POINT	NUMBER			(b)	RANGE	(ppb)	(2S)	(ppb)	DIFF.						
MS/MSD DATA (a)		106/07/89	106/15/89												
Tert Butyl Methyl Ether					2300	92	(c)	2300	92	0.0					
Benzene					2400	96	39-150	2500	100	4.1					
Toluene					2500	100	46-148	2300	92	8.3					
Ethyl benzene					2600	104	32-160	2600	104	0.0					
m- and p-Xylenes					4600	92	(c)	4800	96	4.3					
o-Xylene					2300	92	(c)	2400	96	4.3					
Chlorobenzene					2300	92	55-135	2400	96	4.3					
1,4-Dichlorobenzene					2200	88	42-143	2300	92	4.4					
1,3-Dichlorobenzene					2300	92	50-141	2400	96	4.3					
1,2-Dichlorobenzene					2300	92	37-154	2400	96	4.3					
SAMPLE															
MS	13676M28	106/07/89	106/15/89	NOT REPORTED	(c)										
MSD	13676D29	106/07/89	106/15/89	NOT REPORTED											
13E-SL-WP6-1	13676001	106/07/89	106/13/89		96										
13E-SL-WP6-2	13676002	106/07/89	106/13/89		96										
13E-SL-WP7-1	13676003	106/07/89	106/13/89		95										
13E-SL-WP1-1	13676004	106/07/89	106/13/89		95										
13W-SL-WP1-1	13676005	106/07/89	106/13/89		95										
13W-SL-WP5-1	13676006	106/07/89	106/13/89		95										
17-SL-WP2-1	13676007	106/07/89	106/13/89		95										
17-SL-WP5-1	13676008	106/07/89	106/14/89		94										
14-SL-WP1-1	13676009	106/07/89	106/14/89		95										
14-SL-WP10-1	13676010	106/07/89	106/14/89		94										
14-SL-WP1-2	13676011	106/07/89	106/14/89		95										
14-SL-WP2-1	13676012	106/07/89	106/14/89		94										
14-SL-WP3-1	13676013	106/07/89	106/14/89		94										
1-SL-WP1-1	13676014	106/07/89	106/14/89		108										
11-SL-WP10-1	13676015	106/07/89	106/14/89		106										
1-SL-WP2-1	13676016	106/07/89	106/14/89		108										
1-SL-WP3-1	13676017	106/07/89	106/14/89		108										
1-SL-WP4-1	13676018	106/07/89	106/14/89		108										
18-SL-WP1-1	13676019	106/07/89	106/15/89		108										
18-SL-WP3-1	13676020	106/07/89	106/14/89		107										
18-SL-WP4-1	13676021	106/07/89	106/15/89		95										
18-SL-WP10-1	13676022	106/07/89	106/17/89		92										
METHOD BLANK	06/13/89 (0402)	(d)	106/13/89		96										
METHOD BLK (e)	06/13/89 (1211)	(d)	106/13/89		95										
METHOD BLANK	06/13/89 (2227)	(d)	106/13/89		94										
METHOD BLANK	06/14/89 (0903)	(d)	106/14/89		93										
METHOD BLANK	06/15/89 (0409)	(d)	106/15/89		106										
METHOD BLANK	06/17/89 (1856)	(d)	106/17/89		96										
METHOD BLANK	06/18/89 (1222)	(d)	106/18/89		95										

FOOTNOTES: (a) Matrix Spike/Matrix Spike Duplicates (MS/MSD) samples are run every 20 samples regardless of analysis date.

Acceptable ranges are listed in EPA Method 8020, Table 3, of Test Methods for Evaluating Solid Waste, SW-846 Manual, third edition

(b) TFT - Trifluorotoluene

(c) No acceptable range available

(d) Blank data is supplied for each analysis day.

(e) Method blank used to demonstrate methanol solvent purity.

Table 2.17 (continued) - Volatile Organic Compounds - EPA Methods 8020

MATRIX: SOIL - 13676

		ISURROGATE COMPOUNDS/MATRIX SPIKE DATA				DUPLICATE MATRIX SPIKE DATA						
FIELD	COMPOUND/SAMPLE	DATE SAMPLED	DATE ANALYZED	TFT (b)	SPIKE RANGE (ppb)	ACCU RACY (%)	ACCEPTABLE RANGE (ppb)	SPIKE (2S)	RESULT % RECOVERY	% REL.	FLAG	COMMENTS
SAMPLE	SAMPLE NUMBER											
POINT												
	MS/MSD DATA (a)	106/07/89	106/10/89									
	Tert Butyl Methyl Ether				2400	96	(c)	2500	100	4.1		
	Benzene				2600	104	39-150	2700	108	3.8		
	Toluene				2600	104	46-148	2700	108	3.8		
	Ethyl benzene				2800	112	32-160	2800	112	0.0		
	m- and p-Xylenes				5000	100	(c)	5000	100	0.0		
	Xylene				2500	100	(c)	2500	100	0.0		
	Chlorobenzene				2500	100	55-135	2500	100	0.0		
	1,4-Dichlorobenzene				2400	96	42-143	2400	96	0.0		
	1,3-Dichlorobenzene				2500	100	50-141	2500	100	0.0		
	1,2-Dichlorobenzene				2400	96	37-154	2400	96	0.0		
	SAMPLE											
5-3 MS	5-SL-WP3-1 MS	106/07/89	106/15/89	NOT REPORTED	(c)							
5-3 MSD	5-SL-WP3-1 MSD	106/07/89	106/15/89	NOT REPORTED								
	5-SL-WP3-1	13676023	106/07/89	106/15/89	108	1						
	5-SL-WP3-2	13676024	106/07/89	106/15/89	109	1						
	5-SL-WP2-1	13676025	106/07/89	106/15/89	110	1						
	6-SL-WP1-1	13676026	106/07/89	106/17/89	95	1						
	6-SL-WP2-1	13676027	106/07/89	106/15/89	106	1						
(METHOD BLANK)	06/15/89 (0409)		(d)	106/15/89	106	1						
(METHOD BLANK)	06/17/89 (1856)		(d)	106/17/89	96	1						

FOOTNOTES: (a) Matrix Spike/Matrix Spike Duplicates (MS/MSD) samples are run every 20 samples regardless of analysis date.

Acceptable ranges are listed in EPA Method 8020, Table 3, of Test Methods for Evaluating Solid Waste, SW-846 Manual, third edition

(b) TFT - Trifluorotoluene

(c) No acceptable range available

(d) Blank data is supplied for each analysis day.

Table 2.18 - Volatile Organic Compounds - EPA Methods 8020

MATRIX: WATER - 13701

		ISURROGATE COMPOUNDS/MATRIX SPIKE DATA			DUPLICATE MATRIX SPIKE DATA								
FIELD	COMPOUND/ SAMPLE NUMBER	DATE SAMPLED	DATE ANALYZED	TFT (b)	SPIKE TARGET RANGE (ppb)	ACCURACY (%RECOVERY)	ACCEPTABLE RESULT (%RECOVERY)	RANGE (2S)	RESULT % (ppb)	% RECOVERY	PRECISION % REL.	FLAG	COMMENTS
	MS/MSD DATA (a)	106/08/89	106/23/89										
	Tert Butyl Methyl Ether				< 1	0.0	(c)	< 1	0.0	NA			LOW SPIKE RECOVERY
	Benzene				20.6	103.0	39-150	20.6	103.0	0.0			
	Toluene				19.8	99.0	46-148	18.6	93.0	6.2			
	Ethyl benzene				17.4	87.0	32-160	20.9	104.5	18.3			
	m- and p-Xylenes				51.1	127.8	(c)	35.3	88.3	36.6			
	o-Xylene				20.2	101.0	(c)	18.1	90.5	11.0			
	Chlorobenzene				20.3	101.5	55-135	18.6	93.0	8.7			
	1,4-Dichlorobenzene				20.6	103.0	42-143	19.2	96.0	7.0			
	1,3-Dichlorobenzene				20.6	103.0	50-141	19.0	95.0	8.1			
	1,2-Dichlorobenzene				20.8	104.0	37-154	19.1	95.5	8.5			
	SAMPLE												
MS	MS	106/08/89	106/23/89	NOT REPORTED	(c)								
MSD	MSD	106/08/89	106/23/89	NOT REPORTED									
3E-GW-WP1	23446001	106/08/89	106/17/89	94	!								
3E-GW-WP2	23446002	106/08/89	106/18/89	94	!								
3E-GW-WP3	23446003	106/08/89	106/18/89	94	!								
3E-GW-WP4	23446004	106/08/89	106/18/89	95	!								
3E-GW-WP5	23446005	106/08/89	106/18/89	95	!								
3E-GW-WP7	23446006	106/08/89	106/18/89	97	!								
3E-GW-WP8	23446007	106/08/89	106/23/89	97	!								
3E-GW-WP9	23446008	106/08/89	106/20/89	91	!								
3E-GW-WP10	23446009	106/08/89	106/20/89	91	!								
3W-GW-WP1	23446010	106/08/89	106/20/89	91	!								
3W-GW-WP2	23446011	106/08/89	106/20/89	92	!								
3W-GW-WP3	23446012	106/08/89	106/20/89	91	!								
3W-GW-WP4	23446013	106/08/89	106/20/89	92	!								
7-GW-WP1	23446014	106/08/89	106/20/89	92	!								
7-GW-WP3	23446015	106/08/89	106/21/89	90	!								
7-GW-WP4	23446016	106/08/89	106/21/89	91	!								
7-GW-WP6	23446017	106/08/89	106/21/89	92	!								
7-GW-WP7	23446018	106/08/89	106/21/89	90	!								
4-GW-WP1	23446019	106/08/89	106/21/89	96	!								
4-GW-WP2	23446020	106/08/89	106/21/89	89	!								
4-GW-WP3	23446021	106/08/89	106/21/89	97	!								
4-GW-WP10	23446022	106/08/89	106/21/89	94	!								
1-GW-WP2	23446023	106/08/89	106/21/89	91	!								
1-GW-WP10	23446024	106/08/89	106/21/89	91	!								

FOOTNOTES: (a) Matrix Spike/Matrix Spike Duplicates (MS/MSD) samples are run every 20 samples regardless of analysis date.

Acceptable ranges are listed in EPA method 8020, Table 3, of Test Methods for Evaluating Solid Waste, SW-846 Manual, third edition

(b) TFT - Trifluorotoluene

(c) No acceptable range available

(d) Blank data is supplied for each analysis day.

(e) Not resolved by this method, results reported with 601 analysis.

Table 2.18 (continued) - volatile Organic Compounds - EPA Methods 8020

MATRIX: WATER - 13701

		SURROGATE COMPOUNDS   MATRIX SPIKE DATA				DUPLICATE MATRIX SPIKE DATA					
FIELD	COMPOUND/	DATE	DATE	TFT	SPIKE	ACCURACY	ACCEPTABLE	SPIKE	PRECISION		
SAMPLE	SAMPLE	SAMPLED	ANALYZED	(%)RECOVERY	TARGET	RESULT	(%)RECOVERY	RANGE	RESULT	% RECOVERY	% REL.
POINT	NUMBER			(b)	RANGE	(ppb)	(2S)	(ppb)	DIFF.		FLAG
	MS/MSD DATA (a)	106/08/89	106/23/89								
	Tert Butyl Methyl Ether				30.9	154.5	(c)	3.8	19.0	NA	J
	Benzene				24.3	121.5	39-150	20.3	101.5	17.9	
	Toluene				25	125.0	46-148	19.1	95.5	26.8	
	Ethyl benzene				26.2	131.0	32-160	15.5	77.5	51.3	
	m- and p-Xylenes				48	120.0	(c)	40.0	100.0	18.2	
	o-Xylene				23.7	118.5	(c)	16.9	84.5	33.5	
	Chlorobenzene				23.3	116.5	55-135	20.4	102.0	13.3	
	1,4-Dichlorobenzene				24.7	123.5	42-143	18.9	94.5	26.6	
	1,3-Dichlorobenzene				24.7	123.5	50-141	19.0	95.0	26.1	
	1,2-Dichlorobenzene				24.2	121.0	37-154	19.4	97.0	22.0	
	SAMPLE										
MS	MS	106/08/89	106/23/89	NOT REPORTED	(c)						
MSD	MSD	106/08/89	106/23/89	NOT REPORTED							
1-GW-WP3	23446025	106/08/89	106/21/89	92							
1-GW-WP4	23446026	106/08/89	106/21/89	97							
1-GW-WP5	23446027	106/08/89	106/21/89	97							
1-GW-WP6	23446028	106/08/89	106/21/89	96							
8-GW-WP1	23446029	106/08/89	106/22/89	98							
8-GW-WP2	23446030	106/08/89	106/22/89	83							
8-GW-WP3	23446031	106/08/89	106/22/89	106							
8-GW-WP4	23446032	106/08/89	106/22/89	75							
8-GW-WP10	23446033	106/08/89	106/22/89	90							
6-GW-WP1	23446034	106/08/89	106/22/89	98							
6-GW-WP2	23446035	106/08/89	106/22/89	97							
6-GW-WP3	23446036	106/08/89	106/22/89	97							
5-GW-WP1	23446037	106/08/89	106/22/89	98							
5-GW-WP2	23446038	106/08/89	106/22/89	97							
5-GW-WP3	23446039	106/08/89	106/22/89	97							
FIELD BLANK	23446040	106/08/89	106/22/89	98							
EQUIP. BLANK	23446041	106/08/89	106/22/89	99							
TRAVEL BLANK	23446042	106/08/89	106/22/89	96							
METHOD BLANK	06/17/89 (1856)	(d)	106/17/89	96							
METHOD BLANK	06/20/89 (0908)	(d)	106/20/89	93							
METHOD BLANK	06/21/89 (0316)	(d)	106/21/89	99							
METHOD BLANK	06/21/89 (1513)	(d)	106/21/89	91							
METHOD BLANK	06/22/89 (1120)	(d)	106/22/89	119							
METHOD BLANK	06/22/89 (1450)	(d)	106/22/89	90							
METHOD BLANK	06/22/89 (0340)	(d)	106/22/89	95							

FOOTNOTES: (a) Matrix Spike/matrix Spike Duplicates (MS/MSD) samples are run every 20 samples regardless of analysis date.

Acceptable ranges are listed in EPA Method 8020, Table 3, of Test Methods for Evaluating Solid Waste, SW-846 Manual, third edition

(b) TFT - Trifluorotoluene

(c) No acceptable range available

(d) Blank data is supplied for each analysis day.

(e) Not resolved by this method, results reported with 601 analysis.

Table 2.19 - PAH Compounds - EPA Method 8100

MATRIX: SOIL - 13676

			SURROGATE	MATRIX SPIKE DATA	DUPPLICATE M. SPIKE DI			
			RECOVERY (%)					
FIELD	COMPOUND/	DATE	DATE	DATE	ACCURACY	ACCEPTANCE	PRECISION	PRECISION
SAMPLE	SAMPLE	SAMPLED	EXTRACTED	ANALYZED	TARGET	(%RECOVERY)	RANGE	(%RECOVERY) % REL.
POINT	NUMBER				(b)	RANGE	(2S)	FLAG
	MS/MSD DATA (a)	106/07/89	106/14/89	106/20/89				
	13676M28,-D29							
	Naphthalene				21-1331	73	(c)	71
								3
	Acenaphthylene				33-1451	84	(c)	82
								2
	Pyrene				52-1151	81	(c)	75
								7
	13676M31,-D32	106/07/89	106/14/89	106/20/89				
	Naphthalene				21-1331	72	(c)	77
								6
	Acenaphthylene				33-1451	84	(c)	87
								4
	Pyrene				52-1151	75	(c)	78
								5
	SAMPLE NUMBERS							
MS	13676M28	106/07/89	106/14/89	106/20/89	86	18-1371		
MSD	13676D29	106/07/89	106/14/89	106/20/89	85			
MS1	13676M31	106/07/89	106/14/89	106/20/89	82			
MSD1	13676D32	106/07/89	106/14/89	106/20/89	82			
13E-6 1.51	13676001	106/07/89	106/13/89	106/19/89	88			
13E-6 3.51	13676002	106/07/89	106/13/89	106/19/89	88			
13E-7	13676003	106/07/89	106/13/89	106/19/89	88			
13E-1	13676004	106/07/89	106/13/89	106/19/89	89			
13W-1	13676005	106/07/89	106/13/89	106/19/89	87			
13W-5	13676006	106/07/89	106/13/89	106/19/89	92			
17-2	13676007	106/07/89	106/13/89	106/19/89	99			
17-5	13676008	106/07/89	106/13/89	106/19/89	87			
14-1 SL-WI	13676011	106/07/89	106/14/89	106/20/89	88			
14-2	13676012	106/07/89	106/14/89	106/20/89	68			
14-3	13676013	106/07/89	106/14/89	106/20/89	89			
11-1	13676014	106/07/89	106/14/89	106/20/89	87			
11-10	13676015	106/07/89	106/14/89	106/20/89	92			
11-2	13676016	106/07/89	106/14/89	106/20/89	87			
11-4	13676018	106/07/89	106/14/89	106/20/89	87			
18-3	13676020	106/07/89	106/14/89	106/20/89	87			
18-4	13676021	106/07/89	106/14/89	106/20/89	92			
18-10	13676022	106/07/89	106/14/89	106/20/89	85			
15-3 SL WI	13676023	106/07/89	106/14/89	106/20/89	90			
15-3 WP3-1	13676024	106/07/89	106/14/89	106/20/89	87			
15-2	13676025	106/07/89	106/14/89	106/20/89	85			
IQC BLANK	S06139B1	(c)	106/13/89	106/19/89	87			
IQC BLANK	S06149B1	(c)	106/14/89	106/20/89	92			

FOOTNOTES: (a) Matrix Spike/Matrix Spike Duplicates (MS/MSD) samples are run every 20 samples regardless of analysis date.

(b) TPH - Terphenyl

(c) Blank data is supplied for each day of extraction.

Table 2.20 - PAH Compounds - EPA Method 8100

MATRIX: WATER - 13701

RECOVERY (%)											
FIELD	COMPOUND/	DATE	DATE	DATE		ACCURACY	ACCEPTANCE	PRECISION	PRECISION		
SAMPLE	SAMPLE	SAMPLED	EXTRACTED	ANALYZED	TARGET	(%RECOVERY)	RANGE	(%RECOVERY)	% REL.	FLAG	COMMENTS
POINT	NUMBER				(b)	RANGE		(2S)	DIFF.		
	MS/MSD DATA (a)	106/13/89	106/16/89	106/21/89							
	Naphthalene					80	22-133	80	0.0		
	Acenaphthylene					94	33-145	95	1.1		
	Pyrene					83	52-115	77	7.5		
	SAMPLE NUMBERS										
MS	13701M21	106/13/89	106/16/89	106/21/89	89	33-147					
MSD	13701D22	106/13/89	106/16/89	106/21/89	81						
3E-1	13701001	106/13/89	106/16/89	106/21/89	86						
3E-2	13701002	106/13/89	106/16/89	106/21/89	88						
3E-3	13701003	106/13/89	106/16/89	106/21/89	89						
3E-4	13701004	106/13/89	106/16/89	106/21/89	76						
3E-5	13701005	106/13/89	106/16/89	106/21/89	89						
3E-8	13701006	106/13/89	106/16/89	106/21/89	88						
3E-10	13701007	106/13/89	106/16/89	106/21/89	89						
3E-9	13701008	106/13/89	106/16/89	106/21/89	82						
3W-1	13701009	106/13/89	106/16/89	106/21/89	88						
3W-2	13701010	106/13/89	106/16/89	106/21/89	92						
3W-3	13701011	106/13/89	106/16/89	106/21/89	89						
3W-4	13701012	106/13/89	106/16/89	106/21/89	89						
7-1	13701013	106/13/89	106/16/89	106/21/89	78						
7-3	13701014	106/13/89	106/16/89	106/21/89	91						
7-4	13701015	106/13/89	106/16/89	106/21/89	88						
7-6	13701016	106/13/89	106/16/89	106/21/89	90						
7-7	13701017	106/13/89	106/16/89	106/21/89	76						
FIELD BL	13701018	106/13/89	106/16/89	106/21/89	94						
EQUIP.BL	13701019	106/13/89	106/16/89	106/21/89	96						
TRAVEL BL	13701020	106/13/89	106/16/89	106/21/89	97						
IQC BLANK	W06169B1	(c)	106/16/89	106/21/89	91						

FOOTNOTES: (a) Matrix Spike/Matrix Spike Duplicates (MS/MSD) samples are run every 20 samples regardless of analysis date.

(b) TPH - Terphenyl

(c) Blank data is supplied for each day of extraction.

Table 2.21 - PAH Compounds - EPA Method 8100

MATRIX: WATER - 13726

RECOVERY (%)											
FIELD	COMPOUND/	DATE	DATE	DATE	SURROGATE	MATRIX SPIKE DATA	DUPLICATE M.	SPIKE DI	PRECISION	PRECISION	
SAMPLE	SAMPLE	SAMPLED	EXTRACTED	ANALYZED	TARGET	(%)RECOVERY	RANGE	(%)RECOVERY	% REL.	FLAG	COMMENTS
POINT	NUMBER				(b)	RANGE	(2S)		DIFF.		
	MS/MSD DATA (a)										
	Naphthalene					67	22-133	1	62	8	1
	Acenaphthylene					80	33-145	1	75	6	1
	Pyrene					67	52-115	1	63	6	1
	SAMPLE NUMBERS										
	13726W22	106/15/89	106/19/89	106/21/89	72	33-147					
	13726D23	106/15/89	106/19/89	106/21/89	66						
14-GW-WP21	13726002	106/15/89	106/19/89	106/21/89	71						
14-GW-WP31	13726003	106/15/89	106/19/89	106/21/89	59						
14-GW-WP11	13726004	106/15/89	106/19/89	106/21/89	46						
11-GW-WP11	13726005	106/15/89	106/19/89	106/21/89	84						
11-GW-WP31	13726007	106/15/89	106/19/89	106/21/89	73						
11-GW-WP41	13726008	106/15/89	106/19/89	106/22/89	76						
11-GW-WP51	13726009	106/15/89	106/19/89	106/22/89	31				L	LOW SURROGATE REC	
11-GW-WP61	13726010	106/15/89	106/19/89	106/22/89	80						
18-GW-WP21	13726011	106/15/89	106/19/89	106/22/89	82						
18-GW-WP31	13726012	106/15/89	106/19/89	106/22/89	57						
18-GW-WP41	13726013	106/15/89	106/19/89	106/22/89	87						
18-GW-WP11	13726014	106/15/89	106/19/89	106/22/89	83						
15-GW-WP31	13726015	106/15/89	106/19/89	106/22/89	76						
FIELD BL	13726019	106/15/89	106/19/89	106/22/89	92						
EQUIP. BL	13726020	106/15/89	106/19/89	106/22/89	89						
TRAVEL BL	13726021	106/15/89	106/19/89	106/22/89	83						
QC BLANK	W0619981	(C)	106/19/89	106/22/89	88						

FOOTNOTES: (a) Matrix Spike/Matrix Spike Duplicates (MS/MSD) samples are run every 20 samples regardless of analysis date.

(b) TPH - Terphenyl

(c) Blank data is supplied for each day of extraction.

Table 2.22 - EDB Analysis - EPA Method 504

MATRIX: WATER - 13572

					SURROGATE	MATRIX SPIKE DATA	DUPLICATE M. SPIKE DATA		
					RECOVERY (%)				
FIELD	COMPOUND/	DATE	DATE	DATE		ACCURACY	ACCEPTANCE	PRECISION	PRECISION
SAMPLE	SAMPLE	SAMPLED	EXTRACTED	ANALYZED	TCE TARGET	(%RECOVERY)	RANGE	(%RECOVERY)	% REL.
POINT	NUMBER				(b) RANGE		(2S)		DIFF.
	MS/MSD DATA (a)	105/26/891	NA	106/01/891					
	Ethylene Dibromide					120	(c)	120	0
	Dibromochloropropane					102	(c)	102	0
	SAMPLE NUMBERS								
R2CMS	13572M26	105/26/891	NA	106/01/891	110	(c)			
R2CMSD	13572D27	105/26/891	NA	106/01/891	110				
R4C	13572004	105/26/891	NA	106/01/891	92				
R3C	13572008	105/26/891	NA	106/01/891	106				
R2C	13572014	105/26/891	NA	106/01/891	101				
R1C	13572018	105/26/891	NA	106/01/891	108				
SITE 4	13572020	105/26/891	NA	106/01/891	99				
R5C	13572023	105/26/891	NA	106/01/891	96				
IRINSEATE	13572024	105/26/891	NA	106/01/891	110				
TRIPBLK	13572025	105/26/891	NA	106/01/891	107				
QC_BLANK	W05319B1	(d)	105/31/891	105/31/891	96				

FOOTNOTES: (a) Matrix Spike/Matrix Spike Duplicates (MS/MSD) samples are run every 20 samples regardless of analysis date.

(b) (TCE) = 1,1,2,2-Tetrachloroethane

(c) QC ranges have not been established.

(d) Blank data is supplied for each day of extraction.

Table 2.23 - EDB Analysis - EPA Method 504

MATRIX: SOIL - 13572

					SURROGATE	MATRIX SPIKE DATA	DUPLICATE M. SPIKE DATA		
					RECOVERY (%)				
FIELD	COMPOUND/	DATE	DATE	DATE		ACCURACY	ACCEPTANCE	PRECISION	PRECISION
SAMPLE	SAMPLE	(SAMPLED)	EXTRACTED	ANALYZED	(FB)	TARGET	(%RECOVERY)	RANGE	(%RECOVERY)
POINT	NUMBER				(D)	RANGE	(2S)		% REL.
								DIFF.	FLAG
	MS/MSD DATA (a)	105/26/89	NA	106/07/89					
	1,2-Dibromoethane					102	(c)		
	SAMPLE NUMBERS								
R2CMS	13572M29	105/26/89	NA	106/07/89	102	(c)			
R2CMSP	13572D30	105/26/89	NA	106/07/89	98				
R4C	13572002	105/26/89		106/07/89	88				
R3C	13572006	105/26/89		106/08/89	88				
R2C	13572012	105/26/89		106/07/89	92				
R1C	13572016	105/26/89		106/07/89	97				
R5C	13572022	105/26/89		106/08/89	97				
QC_BLANK	B06079B1	(d)		106/07/89	89				

FOOTNOTES: (a) Matrix Spike/Matrix Spike Duplicates (MS/MSD) samples are run every 20 samples regardless of analysis date.

(b) (FB) = Fluorobenzene

(c) QC ranges have not been established.

(d) Blank data is supplied for each day of extraction.

Table 2.24 - EDB Analysis - EPA Method 504

MATRIX: WATER - 13675

			SURROGATE	MATRIX SPIKE DATA	DUPLICATE M. SPIKE DATA					
			RECOVERY (%)							
FIELD	COMPOUND/	DATE	DATE	DATE	ACCURACY	ACCEPTANCE	PRECISION	PRECISION		
SAMPLE	SAMPLE	SAMPLED	EXTRACTED	ANALYZED	TCE TARGET	(%RECOVERY)	RANGE	(%RECOVERY)	% REL.	FLAG
POINT	NUMBER				(b)	RANGE	(2S)		DIFF.	COMMENTS
	MS/MSD DATA (a)									
	Ethylene Dibromide	NA	NA	NA			NA	(c)	NA	NA
	Dibromochloropropane	NA	NA	NA			NA	(c)	NA	NA
	SAMPLE NUMBERS									
MS	NA	NA	NA	NA	NA	(c)				
MSD	NA	NA	NA	NA	NA	NA				
14-1	13675018	105/26/89	NA	106/13/89	86					
18-1	13675028	105/26/89	NA	106/13/89	85					
TRAVELBL	13675036	105/26/89	NA	106/13/89	102					
FILELBLK	13675038	105/26/89	NA	106/13/89	96					
EQUIPBLK	13675039	105/26/89	NA	106/13/89	97					
QC_BLANK	W0612981	(d)	106/12/89	106/12/89	106					

FOOTNOTES: (a) Matrix Spike/Matrix Spike Duplicates (MS/MSD) samples are run every 20 samples regardless of analysis date.

(b) (TCE) = 1,1,2,2-Tetrachloroethane

(c) QC ranges have not been established.

(d) Blank data is supplied for each day of extraction.

Table 2.25 - EDB Analysis - EPA Method 504

MATRIX: SOIL - 13676

			SURROGATE	MATRIX SPIKE DATA	DUPPLICATE M. SPIKE DATA		
			RECOVERY (%)				
FIELD	COMPOUND/	DATE	DATE	ANALYZED	ACCURACY	ACCEPTANCE	PRECISION
SAMPLE	SAMPLE	ISAMPLED	IEXTRACTED	I (FB)	TARGET	I (%RECOVERY)	RANGE
POINT	NUMBER			I (b)	RANGE	I (25)	I
	MS/MSD DATA (a)	105/26/89	NA	106/21/89			
	1,2-Dibromoethane				113	NA	105
							8
	SAMPLE NUMBERS						
18-9MS	13676M19	105/26/89	NA	106/21/89	NA	NA	
18-9MSD	13676D19	105/26/89	NA	106/21/89	NA		
14-1-SL-WI	13676009	105/26/89	NA	106/21/89	88		
14-10	13676010	105/26/89	NA	106/21/89	90		
11-3	13676017	105/26/89	NA	106/21/89	88		
18-9	13676019	105/26/89	NA	106/21/89	86		
IVBLKS	Y06219B1	I (d)	NA	106/21/89	94		

FOOTNOTES: (a) Matrix Spike/Matrix Spike Duplicates (MS/MSD) samples are run every 20 samples regardless of analysis date.

(b) (FB) = Fluorobenzene

(c) QC ranges have not been established.

(d) Blank data is supplied for each day of extraction.

Table 2.26 - EDB Analysis - EPA Method 504

MATRIX: WATER - 13726

			SURROGATE	MATRIX SPIKE DATA	DUPPLICATE M. SPIKE DATA					
			(RECOVERY (%)							
FIELD	COMPOUND/	DATE	DATE	DATE	ACCURACY	ACCEPTANCE	PRECISION	PRECISION		
SAMPLE	SAMPLE	SAMPLED	EXTRACTED	ANALYZED	TCE TARGET	(%RECOVERY)	RANGE	(%RECOVERY)	% REL.	FLAG
POINT	NUMBER				(b)	RANGE	(2S)		DIFF.	COMMENTS
	MS/MSD DATA (a)	106/15/89	NA	106/20/89						
	Ethylene Dibromide					98	(c)	100	2.0	
	Dibromochloropropane					108	(c)	100	7.7	
	SAMPLE NUMBERS									
MS	13726M22	106/15/89	NA	106/20/89	107	(c)				
MSD	13726D23	106/15/89	NA	106/20/89	100					
3E-6	13726001	106/15/89	NA	106/20/89	102					
1-2	13726006	106/15/89	NA	106/20/89	104					
IQC BLANK	W06199B1	(d)	106/19/89	106/20/89	97					

FOOTNOTES: (a) Matrix Spike/Matrix Spike Duplicates (MS/MSD) samples are run every 20 samples regardless of analysis date.

(b) (TCE) = 1,1,2,2-Tetrachloroethane

(c) QC ranges have not been established.

(d) Blank data is supplied for each day of extraction.

Table 2.27 - PCB Analysis - EPA Method 8080

MATRIX: SOIL - 13572

			SURROGATE	MATRIX SPIKE DATA	DUPPLICATE M. SPIKE DAT		
			RECOVERY (%)				
FIELD	COMPOUND/	DATE	DATE	DATE	ACCURACY	ACCEPTANCE	Precision
SAMPLE	SAMPLE	SAMPLED	EXTRACTED	ANALYZED	4BB TARGET	(%RECOVERY)	RANGE
POINT	NUMBER				(b) RANGE	(2S)	DIFF.
	MS/MSD DATA (a)	105/26/89	106/02/89	106/09/89			
	PCB 1260				91	NA	93
							0
	SAMPLE NUMBERS						
R1DMS	13572W29	105/26/89	106/02/89	106/09/89	105	(c)	
R1DMSD	13572030	105/26/89	106/02/89	106/09/89	105		
R1U	13572015	105/26/89	106/02/89	106/09/89	98		
R1C	13572016	105/26/89	106/02/89	106/09/89	98		
R1D	13572017	105/26/89	106/02/89	106/09/89	97		
PBLK02	W06029B1	(d)	106/02/89	106/08/89	104		

FOOTNOTES: (a) Matrix Spike/Matrix Spike Duplicates (MS/MSD) samples are run every 20 samples regardless of analysis date.

(b) (4BB) = 4-Bromobiphenyl

(c) QC limits are not established.

(d) Blank data is supplied for each day of extraction.

Table 2.28 - PCB Analysis - EPA Method 8080

MATRIX: SOIL - 13676

			SURROGATE	MATRIX SPIKE DATA	DUPLICATE M.	SPIKE DA		
			(RECOVERY (%)					
FIELD	COMPOUND/	DATE	DATE	DATE	ACCURACY	ACCEPTANCE	PRECISION	PRECISION
SAMPLE	SAMPLE	SAMPLED	EXTRACTED	ANALYZED	4BB TARGET	(%RECOVERY)	RANGE	(%RECOVERY)
POINT	NUMBER				(b)	RANGE	(2S)	DIFF.
		MS/MSD DATA (a)	NA	NA	NA			
	PCB 1260					NA	NA	NA
		SAMPLE NUMBERS						
MS	NA	NA	NA	NA	NA	(c)		
MSD	NA	NA	NA	NA	NA			
13E-6 1.5I	13676001	106/07/89	106/13/89	106/16/89	1	88		
13E-6 3.5I	13676002	106/07/89	106/13/89	106/16/89	1	81		
15-3 SL WI	13676023	106/07/89	106/13/89	106/16/89	1	84		
15-3 WP3-I	13676024	106/07/89	106/13/89	106/16/89	1	89		
15-2	13676025	106/07/89	106/13/89	106/16/89	1	94		
PBLK13	S06139B1	(d)	106/13/89	106/15/89	1	99		

FOOTNOTES: (a) Matrix Spike/Matrix Spike Duplicates (MS/MSD) samples are run every 20 samples regardless of analysis date.

(b) (4BB) = 4-Bromobiphenyl

(c) QC limits are not established.

(d) Blank data is supplied for each day of extraction.

Table 3.1 - Total Organic Carbon - EPA Method 415

MATRIX: WATER - 13675

		IMATRIX SPIKE DATA			IDUPLICATE M. SPIKE DATA					
FIELD	COMPOUND/	DATE	DATE	DATE	ACCURACY	ACCEPTANCE	PRECISION	PRECISION	PRECISION	
SAMPLE	SAMPLE	SAMPLED	EXTRACTED	ANALYZED	(%RECOVERY)	RANGE	(%RECOVERY)	% REL.	FLAG	COMMENTS
POINT	NUMBER					(2S)		DIFF.		
	MS/MSD DATA (a)	NA	NA	NA						
	Total Organic Carbon				93	80-120	95	0.7		
	SAMPLE NUMBERS									
4-1	67417	106/07/89	NA	106/26/89						
8-1	67421	106/07/89	NA	106/26/89						
TRAVEL BLK	67430	106/07/89	NA	106/26/89						
FIELD BLK	67431	106/07/89	NA	106/26/89						
EQUIP. BLK	67432	106/07/89	NA	106/26/89						
METHOD BLK	NA	(b)	NA	106/26/89						

FOOTNOTES: (a) MS/MSD was not performed on a sample collected from JANG.

(b) Blank data is supplied for each day of extraction.

Table 3.2 - Total Organic Carbon - EPA Method 415

MATRIX: SOIL - 13676

		MATRIX SPIKE DATA			DUPLICATE M. SPIKE DATA					
FIELD	COMPOUND/	DATE	DATE	DATE	ACCURACY	ACCEPTANCE	PRECISION	PRECISION	FLAG	COMMENTS
SAMPLE	SAMPLE	SAMPLED	EXTRACTED	ANALYZED	(%RECOVERY)	RANGE	(%RECOVERY)	% REL.	DIFF.	
POINT	NUMBER					(2S)				
	MS/MSD DATA (a)	NA	NA	NA						
	Total Organic Carbon				101	80-120	112.2	7.19		
	SAMPLE NUMBERS									
4-1	67297	106/07/89	NA	106/26/89						
4-10	67298	106/07/89	NA	106/26/89						
1-3	67305	106/07/89	NA	106/26/89						
8-1	67307	106/07/89	NA	106/26/89						
METHOD BLK1	NA	(b)	NA	106/26/89						

FOOTNOTES: (a) MS/MSD was not performed on a sample collected from JANG.

(b) Blank data is supplied for each day of extraction.

Table 3.3 - Total Organic Carbon - EPA Method 415

MATRIX: WATER - 13726

		MATRIX SPIKE DATA			DUPLICATE M. SPIKE DATA						
FIELD	COMPOUND/	DATE	DATE	DATE	ACCURACY	ACCEPTANCE	PRECISION	PRECISION			
SAMPLE	SAMPLE	SAMPLED	EXTRACTED	ANALYZED	(%RECOVERY)	RANGE	(%RECOVERY)	% REL.	FLAG	COMMENTS	
POINT	NUMBER					(2S)			DIFF.		
	MS/MSD DATA (a)	NA	NA	NA							
	Total Organic Carbon				93	80-120	95	0.7			
	SAMPLE NUMBERS										
3-6	67618	106/15/89	NA	106/28/89							
1-2	67623	106/15/89	NA	106/28/89							
METHOD BLK	NA	(b)	NA	106/28/89							

FOOTNOTES: (a) MS/MSD was not performed on a sample collected from JANG.

(b) Blank data is supplied for each day of extraction.

Table 3.4 - Total Suspended Solids - EPA Method 160

MATRIX: WATER - 13726

		MATRIX SPIKE DATA		DUPLICATE M. SPIKE DATA			
FIELD	COMPOUND/	DATE	DATE	ACCURACY	ACCEPTANCE	PRECISION	PRECISION
SAMPLE	SAMPLE	SAMPLED	ANALYZED	(%RECOVERY)	RANGE	(%RECOVERY)	% REL.
POINT	NUMBER			(2S)		DIFF.	FLAG
	MS/MSD DATA (a)	NA	NA				
		3	3	3			
	Total Suspended Solids			NA	NA	NA	
	SAMPLE NUMBERS						
3E-6	13726001	106/15/89	106/17/89				
METHOD BLK1	NA	(a)	106/17/89				

FOOTNOTES: (a) Blank data is supplied for each day of extraction.

Table 3.5 - Total Suspended Solids - EPA Method 160

MATRIX: WATER - 13675

		MATRIX SPIKE DATA		DUPLICATE M. SPIKE DA			
FIELD	COMPOUND/	DATE	DATE	ACCURACY	ACCEPTANCE	PRECISION	PRECISION
SAMPLE	SAMPLE	SAMPLED	ANALYZED	(%RECOVERY)	RANGE	(%RECOVERY)	% REL.
POINT	NUMBER				(2S)		FLAG
						DIFF.	COMMENTS
	MS/MSD DATA (a)	NA	NA				
	Total Suspended Solids			NA	NA	NA	
	SAMPLE NUMBERS						
3-3	13675011	106/09/89	NA				
4-2	13675019	106/09/89	NA				
1-6	13675027	106/09/89	NA				
8-3	13675030	106/09/89	NA				
METHOD BLK	NA	(a)	NA				

FOOTNOTES: (a) Blank data is supplied for each day of extraction.

MATRIX: WATER - 13572

Table 4.1 - Metals Analysis - EPA Methods 7000, 7470, 6000

KNOWN REFERENCE SAMPLES										MATRIX SPIKE (ACCURACY) IDUPLICATE (PRECISION)						
METAL	METHOD	DATE	DATE	SAMPLED	ANALYZED	TRUE	%	CONTROL	PERCENT	ACCEPTABLE	PERCENT	CONTROL	PREP	BLANK	FLAG	COMMENTS
ARSENIC	F	05/26/89	06/09/89	35.24	37.6	93.7	80-120	83.5	75-125	1	0	20	-0.76	1		
BARIUM	P	05/26/89	06/09/89	2013.33	2010	100.2	80-120	100.9	75-125	1	15.6	20	3.439	1		
CADMIUM	P	05/26/89	06/09/89	524.12	492	106.5	80-120	113.4	75-125	1	0	20	1	1		
CHROMIUM	P	05/26/89	06/09/89	520.89	503	103.6	80-120	118.7	75-125	1	0	20	6.28	1		
LEAD	F	05/26/89	06/09/89	37.16	39.2	94.8	80-120	89.5	75-125	1	1.9	20	1	1		
MERCURY	CV	05/26/89	06/12/89	3.58	4.4	81.4	80-120	105.0	75-125	1	0	20	1	1		
SELENIUM	F	05/26/89	06/09/89	69.9	41.6	168.0	80-120	81.0	75-125	1	0	20	-0.87	1		
SILVER	P	05/26/89	06/09/89	NA	NA	NA	NA	68.6	75-125	1	0	20	1	1		

MATRIX: SOIL - 13572

Table 4.2 - Metals Analysis - EPA Methods 7000, 7470, 6000

KNOWN REFERENCE SAMPLES										MATRIX SPIKE (ACCURACY)				IDPLICATE (PRECISION)		
METAL	METHOD	DATE	SAMPLED	ANALYZED	OBSERVED	TRUE	%	CONTROL	PERCENT	ACCEPTABLE	PERCENT	CONTROL	PREP	BLANK	IFLAG	COMMENTS
						VALUE	VALUE	RECOVERY	LIMITS	RECOVERY	RANGE	RPD	LIMITS			
ARSENIC	F	05/26/89	06/09/89		880.3	917	96	80-120	1	82.0	75-125	1	5.3	35	-0.76	1
BARIUM	P	05/26/89	06/09/89		5.4	4.8	112.3	80-120	1	97.6	75-125	1	0	35	3.439	1
CADMIUM	P	05/26/89	06/09/89		42	45.4	92.5	80-120	1	100.5	75-125	1	17.8	35	1	1
CHROMIUM	P	05/26/89	06/09/89		98.3	99.6	79.2	80-120	1	102.4	75-125	1	26.5	35	6.28	L
LEAD	F	05/26/89	06/09/89		197.4	236	83.6	80-120	1	56.0	75-125	1	0.7	35	1	LOW LCS RECOVERY
MERCURY	CV	05/26/89	06/12/89		10.8	12.7	85	80-120	1	94.7	75-125	1	0	35	1	1
SELENIUM	F	05/26/89	06/09/89		30.4	39.2	77.6	80-120	1	100.0	75-125	1	0	35	-0.87	L
SILVER	P	05/26/89	06/09/89		NA	NA	NA	NA	1	92.6	75-125	1	0	35	1	1

Table 4.3 - Metals Analysis - EPA Methods 7000, 7470, 6000

MATRIX: WATER ~ 13675		KNOWN REFERENCE SAMPLES										MATRIX SPIKE (ACCURACY) IDPLICATE (PRECISION)				
METAL	METHOD	DATE	ANALYZED	OBSERVED	TRUE	%	CONTROL	PERCENT	ACCEPTABLE	PERCENT	CONTROL	PREP	BLANK	IFLAG	COMMENTS	
ARSENIC	F	06/09/89	06/15/89	39.58	37.6	105.3	80-120	99.5	75-125	1	0	20	1	1		
BARIUM	P	06/09/89	06/15/89	2199.2	2010	109.4	80-120	102/104	75-125	1	18.7.7	20	1	2.31		
CADMIUM	P	06/09/89	06/15/89	553.23	492	112.4	80-120	103/98.6	75-125	1	16.9/0	20	1	1		
CHROMIUM	P	06/09/89	06/15/89	557.39	503	110.8	80-120	105/104	75-125	1	0/2.2	20	1	1		
LEAD	F	06/09/89	06/15/89	41.43	39.2	105.7	80-120	86.5/95	75-125	1	3.4/17.2	20	1	0.77		
MERCURY	CV	06/09/89	06/21/89	5.39	4.9	110	80-120	85	75-125	1	0	20	1	1		
SELENIUM	F	06/09/89	06/15/89	76.85	83.2	92.4	80-120	96	75-125	1	0	20	1	1		
SILVER	P	06/09/89	06/15/89	533.72	484	110.3	80-120	96/90.2	75-125	1	0/0	20	1	1		

Table 4.4 - Metals Analysis - EPA Methods 7000, 7470, 6000

MATRIX: SOIL - 13676

KNOWN REFERENCE SAMPLES										MATRIX SPIKE (ACCURACY) DUPLICATE (PRECISION)							
METAL	METHOD	DATE	SAMPLED	ANALYZED	OBSERVED	TRUE	%	CONTROL	PERCENT	ACCEPTABLE	PERCENT	CONTROL	PREP	LIMITS	BLANK	IFLAG	COMMENTS
ARSENIC	F	06/09/89	06/15/89	707.6	917	77.2	80-120	83.2	75-125	0.98-2	35	1	2.9	L	1	LOW LCS RECOVERY	
BARIUM	P	06/09/89	06/15/89	4.7	4.8	97.9	80-120	90.6	75-125	0/11.7	35	1	4.43	1			
CADMIUM	P	06/09/89	06/15/89	38.1	45.4	83.9	80-120	91.8	75-125	0/0	35	1	1				
CHROMIUM	P	06/09/89	06/15/89	91.2	99.6	91.6	80-120	93.0	75-125	0/16.3	35	1	4.023	1			
LEAD	F	06/09/89	06/15/89	222/196	236/236	94.2/63.4	80-120	136/120	75-125	0/3.2/17	35	1	0.77	K	1	HIGH SPIKE RECOVERY	
MERCURY	CV	06/09/89	06/25/89	12.4	12.7	97.6	80-120	108/109	75-125	0/0	35	1	1				
SELENIUM	F	06/09/89	06/15/89	24.6	39.2	62.8	80-120	80.0	75-125	0/0	35	1	1	L	1	LOW LCS RECOVERY	
SILVER	P	06/09/89	06/15/89	18.4	22.2	82.9	(a)	90.1	75-125	0/0	35	1	1				

(a) No control limits have been established.

MATRIX: WATER - 13726

Table 4.5 - Metals Analysis - EPA Method 7000, 7470, 6000

	KNOWN REFERENCE SAMPLES			MATRIX SPIKE (ACCURACY) DUPLICATE (PRECISION)									
METAL	METHOD	DATE	SAMPLED	ANALYZED	TRUE	% CONTROL	ACCEPTABLE	PERCENT	CONTROL	PREP	BLANK	FLAG	COMMENTS
ARSENIC	F	06/15/89	06/22/89	35.3	37.6	93.9	80-120	96.4	75-125	11.3	20	1	
BARIUM	P	06/15/89	06/22/89	1922.3	2010	95.6	80-120	94.9	75-125	1.8	20	1	11.1
CADMIUM	P	06/15/89	06/22/89	461	492	93.7	80-120	98	75-125	0	20	1	
CHROMIUM	P	06/15/89	06/22/89	467	503	92.8	80-120	87.5	75-125	59.2	20	-4	M DUP. PRECISION NOT MET
LEAD	F	06/15/89	06/22/89	38.66	39.2	98.6	80-120	NOT REPORTED	75-125	16.2	20	1	
MERCURY	CV	06/15/89	06/20/89	5.39	4.9	110	80-120	72.7	75-125	0	20	1	L LOW SPIKE RECOVERY
SELENIUM	F	06/15/89	06/22/89	40.04	41.6	96.2	80-120	93.5	75-125	30.3	20	1	M DUP. PRECISION NOT MET
SILVER	P	06/15/89	06/22/89	47.9	48.4	99	80-120	90	75-125	0	20	1	

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**APPENDIX F**  
*Data Validation Technical Memoranda  
for the Second Step of the Site Investigation*

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## **FOREWORD**

Data for the second step of the site investigation were validated by CH2M HILL staff members (Chris Ohland and Ann Castleberry) who are not employed by CH2M HILL Environmental Laboratories, Inc. The following technical memoranda describe site investigation data, their quality, and their usability. Data validation for data obtained during the second step of the site investigation through December 1989 is described in the memorandum dated February 2, 1990. Data validation for additional samples obtained during November 1990 at Site 6 is described in the memorandum dated December 3, 1990. The term remedial investigation (RI) is used incorrectly in the first memorandum and should be read as site investigation (SI).

## TECHNICAL MEMORANDUM

**TO:** Ann Castleberry/MGM  
**FROM:** Chris Ohland/GLO  
**DATE:** February 2, 1990  
**SUBJECT:** Data Validation for Jacksonville ANG Remedial Investigation  
**PROJECT:** GNV27267.JX.RI

## 1.0 INTRODUCTION

This memorandum presents the data validation discussion and summary tables for the Jacksonville Air National Guard remedial investigation (RI) laboratory data. Data validation is the technical review of a data package using criteria established in the data quality objectives of the Quality Assurance Project Plan.

During the RI, 16 soil and 35 water samples were collected and analyzed for various organic and inorganic parameters. The analyses are:

- Semivolatiles by gas chromatography/mass spectrophotometer (GC/MS);
- Volatile halocarbons by gas chromatography (GC);
- Volatile aromatics by GC;
- Polynuclear aromatic hydrocarbons (PAH) by GC;
- Total hardness;
- Total suspended solids (TSS); and
- Metals.

Participating laboratories were required to submit the Hazardous Materials Remedial Action Program (HAZWRAP) Level C QC data packages for data generated for the Jacksonville Air National Guard RI. Table 1.1 summarizes the Level C data package deliverables.

Data were reviewed and validated using HAZWRAP Level C Data Validation Guidelines [1]. For hardness and TSS methods a procedure that outlines samples holding times, initial calibration, continuing calibration, matrix spike, blank spike, and blank versus sample results was reviewed. In addition, the EPA Laboratory Data Validation Functional Guidelines [2,3] were used to

Table 1.1 (Page 1 of 2)  
SUMMARY OF LEVEL C DATA PACKAGE DELIVERABLES

### **GC/MS ORGANIC ANALYSES**

<u>CLP Form No.</u>	<u>Purpose</u>
I	Data Summary
II	Surrogate Recovery
III	MS/MSD
IV	Method Blank
V	GC/MS Tuning
VI	Initial Calibration Data
VII	Continuing Calibration
VIII	Internal Standard Area
X	Holding Times
**	Laboratory Control Charts for Blank Spikes
**	Sample Raw Data Package

### **GC ORGANIC ANALYSES**

<u>CLP Form No.</u>	<u>Purpose</u>
I	Data Summary
II	Surrogate Recovery
III	MS/MSD
IV	Method Blank
VI	Initial Calibration Data
VII	Continuing Calibration
VIII	Internal Standard Area
IX	Pesticide/PCB Calibration Data
X	Holding Times
**	Initial Calibration Data with Response Factors and Their Percent Difference from the Initial Calibration
**	Chromatograms of Second-Column Confirmation Work
**	Laboratory Control Charts for Blank Spikes
**	Sample Raw Data Package

Table 1.1 (Page 2 of 2)

**INORGANICS**

<u>CLP Form No.</u>	<u>Purpose</u>
I	Data Summary
II	Initial and Continuing Calibration
III	Blanks (10% Frequency)
IV	ICP Interference Check
V, Part 1	Spike Results
V, Part 2	Postdigestion Spike Recovery (ICP only)
VI	Duplicate (1 in 20)
VIII	Standard Addition Results
X	Holding Times
**	Laboratory Control Charts for Blank Spikes
**	Sample Raw Data Package

GLT949/028.50

## **TECHNICAL MEMORANDUM**

Page 2

February 2, 1990

GNV27267.JX.RI

supplement HAZWRAP guidelines when no acceptance ranges or control limits are established.

When samples were received by the laboratory, they were assigned unique laboratory numerical identifiers. The sample numbering system ensures that the sample identity is unknown to the analyst. Table 1.2 correlates field sample point to laboratory number for ease in locating specific field site. Samples were analyzed in CH2M HILL laboratories in Montgomery, Alabama, and Gainesville, Florida.

For ease of discussion, the results of the validation process are discussed in the following order: organic analyses, wet laboratory analyses, and inorganic analyses.

## **2.0 ORGANIC ANALYSES**

### **2.1 INTRODUCTION**

The organic analyses data were reviewed and validated using HAZWRAP Level C Data Validation Guidelines and supplemented using the guidance document "Laboratory Data Validation Functional Guidelines for Evaluating Organics Analyses" [2]. The required data deliverables as specified under Level C are laboratory control charts and forms analogous to those required in the CLP Statement of Work (SOW) [4]. The validation guidance list criteria for evaluating the complete data package form by form. A quick review of the forms is useful for understanding the validation process. The forms summarize and present the raw, experimental data.

**Form I--Data Sheet** presents the sample results and the information necessary for calculating holding times and is reviewed for completeness. Holding time is defined as the time, in days, from the collection of the sample to the extraction or analysis. It is important to note that the holding time for extraction is often different for water and soils for the same analytical method. Table 2.1 presents the EPA recommended holding times.

**Form II--Surrogate Recovery** summarizes the surrogate spike recovery data. Surrogate compounds are the structural homologs of target list compounds, often with deuterium substituted for hydrogen, and are therefore expected to behave in a similar manner during the analysis. Spike recoveries demonstrate laboratory performance and are evaluated using acceptance ranges delineated in the CLP SOW. Spike recoveries can also be used to estimate accuracy, which is a measure of the agreement between an experimental determination and the true value of the parameter being measured.

TABLE 1.2; SAMPLE CROSS REFERENCE

Matrix	Date Sample Collected	Sample Description	Sample Number	LMG Sample Numbers	
				Organic	Inorganic
SOIL	11/28/89	8-SL-MW3-1 (1-3')	73761		14969011
SOIL	11/28/89	8-SL-MW3-2 (3-5')	73762		14969012
SOIL	11/28/89	8-SL-MW2-1 (1-3')	73763		14969013
SOIL	11/28/89	8-SL-MW2-2 (3-5')	73764		14969014
SOIL	11/28/89	8-SL-MW1-1 (1-3')	73765		14969015
SOIL	11/28/89	8-SL-MW4-1 (1-3')	73766		14969016
SOIL	11/28/89	8-SL-MW1-2 (3-5')	73767		14969017
SOIL	11/28/89	8-SL-SB5-1 (1-3')	73768		14969018
SOIL	11/28/89	8-SL-SB5-2 (3-5')	73769		14969019
SOIL	11/28/89	BK-SL-1 (1-2')	73770	14959001	14969020
SOIL	11/28/89	BK-SD-1	73771	14959002	14969021
SOIL	11/28/89	DG1-SD-1	73772	14959003	14969022
SOIL	11/28/89	DG2-SD-1	73773	14959004	14969023
WATER	12/01/89	6-GW-MW1	73859		14969001
WATER	12/01/89	6-GW-MW2	73860		14969002
WATER	12/01/89	7-GW-WP5A	73861	14964001	14969003
WATER	12/01/89	7-GW-WP2A	73862	14964002	14969004
WATER	12/01/89	3W-GW-WP5A	73863	14964003	14969005
WATER	12/01/89	DG1-SW	73864	14964004	14969006
WATER	12/01/89	DG2-SW	73865	14964005	14969007
WATER	12/01/89	2-GW-WP13	73866		
WATER	12/01/89	POTABLE DECON WATER	73867	14964006	14969008
WATER	12/01/89	2-GW-WP12	73868		
WATER	12/01/89	BAILER BLANK	73869	14964007	14969009
WATER	12/01/89	FIELD BLANK	73870	14964008	14969010
WATER	12/01/89	TRIP BLANK	73871		
WATER	12/04/89	3E-GW-MW1	73952		14996001
WATER	12/04/89	2-GW-WP13	73953		14996002
WATER	12/04/89	2-GW-WP13 (FILTERED)			14996008
WATER	12/04/89	2-GW-WP12	73954		14996003
WATER	12/04/89	2-GW-WP12 (FILTERED)			14996009
WATER	12/05/89	1-GW-MW1	73955		14996005
WATER	12/05/89	1-GW-MW2	73956		14996006
WATER	12/05/89	POTABLE DECON WATER C.E.4	73957	14988006	14996007
WATER	12/04/89	3E-GW-MW3	73959		
WATER	12/04/89	3E-GW-MW2	73960		
WATER	12/04/89	5-GW-MWB	73961		
WATER	12/04/89	5-GW-MWC	73962		
WATER	12/04/89	5-GW-MWA	73963		
WATER	12/04/89	BAILER BLANK #2	73964		
WATER	12/04/89	TRAVEL BLANK	73965		14996004
WATER	12/05/89	5-GW-MW1	73966		
WATER	12/05/89	5-GW-MW2	73967		
WATER	12/05/89	8-GW-MW3	73968	14988001	
WATER	12/05/89	8-GW-MW2	73969	14988002	
WATER	12/05/89	8-GW-MW1	73970	14988003	
WATER	12/05/89	8-GW-MW4	73971	14988004	
WATER	12/05/89	BAILER BLANK #3	73972	14988005	

Table 2.1  
HOLDING TIME LIMITS

<u>Analysis</u>	<u>Method</u>	<u>Extraction Criteria</u>	<u>Analysis Criteria</u>
		<u>Water</u>	<u>Soil</u>
PNAs	610/8100	7 days	14 days
Volatile Halocarbons	601/8010	--	--
Volatile Aromatics	602/8020	--	--
Semivolatiles	625/8270	7 days	14 days
Metals by GFAA	7000	--	--
Mercury by GFAA	7470	--	--
Metals by ICP	6000	--	--
TSS	160.2	--	--
Total Hardness	130.2	--	--

GLT949/026.50

## **TECHNICAL MEMORANDUM**

Page 3

February 2, 1990  
GNV27267.JX.RI

**Form III--Matrix Spike/Matrix Spike Duplicate (MS/MSD) Recovery** presents the recoveries of the MS/MSD compounds. Matrix spike compounds are found on the method target compound list (TCL). The field sample is split and a portion is spiked with known quantities of TCL compounds in order to ascertain the effects of the specific sample matrix on the recovery of analytes.

Acceptance ranges are delineated in the CLP SOW. MS/MSD spike recoveries can also be used to estimate accuracy and precision. Precision is a measure of the agreement or repeatability of a set of replicate results obtained from duplicate analyses made under the same conditions.

**Form IV--Method Blank Summary** sheets correlate method blanks to samples. Method blanks are ASTM Type II (distilled, deionized) water that is treated as a sample in the laboratory. In other words, the method blank undergoes the same analytical process as the corresponding samples. Method blanks are used to monitor laboratory performance and contamination introduced during the analytical procedure. Usual frequency is 1 in 10 or 20 (depending on the analytical method) or one per batch, whichever is more frequent.

**Form V--GC/MS Tuning and Mass Calibration** presents the tuning and mass calibration information for each GC/MS instrument used to produce data in the data package. The CLP SOW establishes tuning and performance criteria in order to ensure mass resolution, identification, and, to some degree, sensitivity. These criteria are not sample specific, and conformance is determined using standard materials; therefore, these criteria should be met in all circumstances. For volatiles analyses, Bromofluorobenzene (BFB) is used; for semivolatiles, Decafluorotriphenylphosphine (DFTPP). Tuning compounds for PCB, EDB, and PAH using GC/MS are not reported. Analysis for PCB, EDB, and PAH using a gas chromatograph do not require tuning.

**Forms VI and VII--Initial and Continuing Calibration** are used to report compound recoveries from calibration solutions. Initial calibration data demonstrate that the analytical instrument is performing satisfactorily and is capable of producing acceptable quantitative data at the beginning of the analytical period. Continuing calibration checks document that the instrument continues to produce acceptable data. Calibration data must fall within the specified acceptance criteria for analysis to begin or continue.

**Form VIII A--Internal Standards** presents the internal standards peak area information. Internal standard compounds are used to provide information about analytical instrument sensitivity and response during every run. Acceptance criteria are established in the functional guidelines.

Additional areas for review include TCL compound identification, compound quantitation and reported detection limits, and tentatively identified compounds.

## **TECHNICAL MEMORANDUM**

Page 4

February 2, 1990  
GNV27267.JX.RI

### **2.2 ORGANIC DATA VALIDATION SUMMARY TABLES**

Before the analytical results are released from the laboratory, both the sample and the quality control data must be reviewed carefully. Laboratory personnel review the raw data to verify sample identity, instrument calibration, detection limits, numerical computations, accuracy of transcriptions, and chemical interpretations. Additionally, the quality control samples are processed to demonstrate that the analytical results are within laboratory prescribed criteria for accuracy and precision. This memorandum includes only summary tables for the data validation process. The original data sheets and data summary tables appear elsewhere in the RI report.

The data validation tables in this section summarize the quality assurance/quality control (QA/QC) information for each laboratory sample batch by analyses. They are arranged by analyses and separated by sample delivery group.

The information presented in the summary tables includes MS/MSD percent recovery and precision, surrogate spike recovery, internal standards, holding time, and laboratory method blank analyses. The summary tables organize samples by the corresponding MS/MSD samples. Data that does not strictly meet the criteria are flagged with letter abbreviations that indicate a problem with the data. The flags are also included in the data summary tables so that the possible limitations of data quality will be considered before the data is used to support project decisions. Acceptable matrix spike recovery ranges are defined in the appropriate method or by control charts. Acceptable ranges for surrogate recoveries from the CLP SOW [4] were applied to semivolatiles. Acceptance ranges for surrogate recoveries from the control charts were applied to the remaining analyses. Table 2.2 summarizes the acceptable limits for each analysis and a source reference.

Lettered flags used in the text include:

- U** Undetected. Analyte was analyzed for but not detected above the method detection limit.
- B** Analyte was detected in the sample at a concentration less than five times the concentration (ten times for common contaminants) in the associated laboratory or field blank.
- J** Estimated. Analyte was present but the reported value may not be accurate or precise. For example, the MS/MSD precision is outside the acceptable range and the data may be biased high or low.

## **TECHNICAL MEMORANDUM**

Page 5

February 2, 1990  
GNV27267.JX.RI

- K Analyte was present but the reported value may be biased high; the actual value is expected to be lower. For example, the surrogate spike recovery was above the acceptable limits.
- L Analyte was present but the reported value may be biased low; the actual value is expected to be higher. For example, the holding time was exceeded or the surrogate spike recovery was below the acceptable limits.
- M Duplicate precision was not met. It is not possible to determine whether the resulting bias is high or low.

It is important to note that the Data Sheets (Form I) also contain flags and the usage is the same as listed above. Under the current CLP SOW, the laboratory is required to report any analyte concentration that is above the instrument detection limit but below the Contract Required Quantitation Limit (CRQL). These analyte concentrations are labeled with a "J" for data estimated.

The summary tables for a given analytical method are presented by laboratory number (in ascending sequential order). The data validation summary tables are discussed below.

### **2.2.1 Semivolatiles--EPA Method 8270**

Table 2.3 summarizes the QA/QC data for four low concentration soil samples.

Initial calibration relative standard deviation (percent RSD) criteria were met for all target analyte compounds, except benzoic acid (31.2 percent). Continuing calibration percent difference (percent D) criteria (= <25 percent) were met for all target analyte compounds, except hexachlorobenzene (90.6 percent). Because the out-of-control target analytes were not detected in any of the samples, no qualification of the data was applied. All other QA/QC measures were met, and the data are acceptable.

### **2.2.2 Volatile Halocarbons and Volatile Aromatics--EPA Methods 601/602/8010/8020**

Tables 2.4 through 2.6 summarize the QA/QC data for the purgeable halocarbons and aromatic analyses. The performing laboratory uses a modified EPA Method 601/602 for water samples and modified EPA Method 8010/8020 for soil samples. The laboratory modifies the methods by combining the halocarbon and aromatic analyses into a single analysis. This is accomplished by

Table 2.2 (Page 1 of 2)  
SUMMARY OF ACCEPTABLE RECOVERY RANGES FOR ORGANIC METHODS

**VOLATILES--EPA METHOD 8010**

<u>Compound</u>	<u>MS/MSD (% Recovery)</u>	
	<u>Water</u>	<u>Soil</u>
Chloromethane	D-193	D-193
Bromomethane	D-144	D-144
Dichlorodifluoromethane	(c)	(c)
Vinyl chloride	D-144	D-144
Chloroethane	46-137	46-137
Methylene chloride	25-162	25-162
Trichlorofluoromethane	21-156	21-156
1,1-Dichloroethene	28-167	28-167
1,1-Dichloroethane	47-132	47-132
trans-1,2-Dichloroethene	38-155	38-155
Chloroform	49-133	49-133
1,2-Dichloroethane	51-147	51-147
1,1,1-Trichloroethane	41-138	41-138
Carbon Tetrachloride	43-143	43-143
Bromodichloromethane	42-172	42-172
1,2-Dichloropropane	44-156	44-156
cis-1,3-Dichloropropene	22-178	22-178
Trichloroethene	35-146	35-146
Dibromochloromethane	24-191	24-191
1,1,2-Trichloroethane	39-136	39-136
trans-1,3-Dichloropropene	22-178	22-178
Bromoform	13-159	13-159
1,1,2,2-Tetrachloroethane	8-184	8-184
Tetrachloroethene	26-162	26-162
Chlorobenzene	38-150	38-150
1,3-Dichlorobenzene	7-187	7-187
1,2-Dichlorobenzene	D-208	D-208
1,4-Dichlorobenzene	42-143	42-143
Bromochloromethane	-	-

**VOLATILES - EPA METHOD 8020**

<u>Compound</u>	<u>MS/MSD (% Recovery)</u>	
	<u>Water</u>	<u>Soil</u>
Tert Butyl Methyl Ether	(c)	(c)
Benzene	39-150	39-150
Toluene	46-148	46-148
Ethylbenzene	32-160	32-160
Xylene	(c)	(c)
Chlorobenzene	55-135	55-135
1,4-Dichlorobenzene	42-143	42-143
1,3-Dichlorobenzene	50-141	50-141
1,2-Dichlorobenzene	37-154	37-154

Table 2.2 (Page 2 of 2)

<u>Compound</u>	<u>Surrogate (% Recovery)</u>	
	<u>Water</u>	<u>Soil</u>
Trifluorotoluene	-	-
<b>PAHs--EPA Method 8100</b>		<u>MS/MSD (% Recovery)</u>
<u>Compound</u>	<u>Water</u>	<u>Soil</u>
Naphthalene	22-133	21-133
Acenaphthylene	33-145	33-145
Pyrene	52-115	52-115
<u>Compound</u>	<u>Surrogate (% Recovery)</u>	
	<u>Water</u>	<u>Soil</u>
Terphenyl	33-147	-
<b>SEMIVOLATILES--EPA METHOD 8270</b>		<u>MS/MSD (% Recovery)</u>
<u>Compound</u>	<u>Water</u>	<u>Soil</u>
1,2,4-Trichlorobenzene	39-98	38-107
Acenaphthene	46-118	31-137
2,4-Dinitrotoluene	24-96	28-89
Pyrene	26-127	35-142
N-Nitroso-Di-n-Propylamine	41-116	41-126
1,4-Dichlorobenzene	36-97	28-104
Pentachlorophenol	9-103	17-109
Phenol	12-89	26-90
2-Chlorophenol	27-123	25-102
4-Chloro-3-Methylphenol	23-97	26-103
4-Nitrophenol	10-80	11-114
Nitrobenzene	35-114	23-120
2-Fluorobiphenyl	43-116	30-115
p-Terphenyl	33-141	18-137
Phenol	10-94	24-113
2-Fluorophenol	21-100	25-121
2,4,6-Tribromophenol	10-123	19-122

GLT949/027.50

TABLE 2.3: QA/QC DATA FOR THE SEMIVOLATILE ANALYSIS – EPA METHOD 8270

MATRIX	4 LOW CONC. SOILS																				
CASE NUMBER	14959																				
LABORATORY	CH2M HILL/MONTGOMERY AL																				
MS/MSD ACCURACY and PRECISION DATA																					
MATRIX SPIKE COMPOUND	RECOVERY (%)	RPD (REC./MSD)	RANGES																		
MS	MSD	(%)	REC.	RPD																	
Phenol	68	73	-7	12-89	42																
2-Chlorophenol	64	68	-6	27-123	40																
1,4-Dichlorobenzene	69	69	0	06-97	28																
N-Nitroso-di-n-propylamine	93	99	-6	41-116	38																
1,2,4-Trichlorobenzene	73	66	10	39-98	28																
4-Chloro-3-methylphenol	75	64	15	23-97	42																
Acenaphthene	75	71	5	46-118	31																
4-Nitrophenol	100	103	-2	10-80	50																
2,4-Dinitrotoluene	86	92	-6	24-96	38																
Pentachlorophenol	74	62	17	09-103	50																
Pyrene	86	61	34	26-127	31																
SPIKE LEVEL = 8760 UG/KG (ACID)			FLAG: NONE																		
SAMPLE SPECIFIC QA/QC DATA			FLAG: NONE																		
LAB	SITE	NBZ	SURROGATE RECOVERY (%)		INTERNAL STANDARD PERFORMANCE (%)		CONTAMINANT		GENERAL COMMENTS,												
NUMBER	IDENTIFICATION	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	BLANK	CONTAMINATION,										
		TAKEN	EXT	ANAL	DCB	NPT	ANT	PHN	CRY	FLD	BLANK										
		(#)	(#)	(#)	(#)	(#)	(#)	(#)	(#)	ID	CMPS										
14959001	BK-SL-1 (1-2)	75	79	75	72	66	99	11/28	12/08	12/15	96.2	95.3	92.3	113.1	103.8	97.7	N	NA	S12089B1	0	0
14959002	BK-SD-1	73	92	77	71	66	98	11/28	12/08	12/15	91.7	89.3	80.4	106.1	92.9	90.9	N	NA	S12089B1	1	2
14959003	DG1-SD-1	67	92	84	71	62	105	11/28	12/08	12/15	89.8	89.8	78.0	107.1	90.5	86.6	N	NA	S12089B1	0	0
14959004	DG2-SD-1	72	90	78	74	71	109	11/28	12/08	12/15	87.9	91.2	81.1	104.4	95.4	89.6	N	NA	S12089B1	0	0
14959M05	BK-SD-1-MS	79	86	86	72	67	81	NA	12/08	12/15	86.6	82.1	84.4	99.6	86.4	85.3	N	NA	S12089B1	NA	NA
14959D06	BK-SD-1-MSD	91	92	86	77	83	106	NA	12/08	12/14	87.3	88.3	85.6	104.6	101.1	95.1	N	NA	S12089B1	NA	NA
S12089B1	NA	73	82	88	76	73	80	NA	12/08	12/15	86.0	83.2	83.5	93.3	77.1	72.6	N	NA	0	1	TIC = HEXANEDIOIC ACID ESTER (8700 UG/KG)

- (a) NBZ - Nitrobenzene (35-114)      (c) TPH - Terphenyl (33-141)      (e) 2FP - 2-Fluorophenol (21-100)  
 (b) FBP - 2-Fluorobiphenyl (43-116)      (d) PHL - Phenol (10-94)      (f) TBP - 2,4,6-Tribromophenol (10-123)

TABLE 2.4; QA/QC DATA FOR THE PURGEABLE HALOCARBONS AND AROMATIC COMPOUNDS ANALYSIS - EPA METHODS 8010/8020

MATRIX	4 LOW SOILS										
	CASE NUMBER		LABORATORY		CH2M Hill/GAINSVILLE FL						
MATRIX SPIKE COMPOUND	MS/MSD ACCURACY and PRECISION DATA				GENERAL QA/QC				GENERAL COMMENTS:		
	MS	MSD	RECOVERY (%)	RPD	RANGES REC.	RPD	RANGES REC.	RPD			
CHLOROMETHANE	119.0	84.0	34	D-193	(c)				INITIAL CALIBRATION: GC#1; ALL ICAL CRITERIA MET GC#2; ALL ICAL CRITERIA MET		
VINYL CHLORIDE	91.0	70.5	25	28-163	(c)						
BROMOMETHANE	106.0	91.0	15	D-144	(c)						
CHLOROETHANE	87.7	71.3	20	46-137	(c)						
1,1-DICHLOROETHENE	103.5	95.0	8	28-167	(c)				CONTINUING CALIBRATION: GC#1; ALL CCAL CRITERIA MET GC#2; ALL CCAL CRITERIA MET		
METHYLENE CHLORIDE	87.5	73.0	18	25-162	(c)						
1,2-DICHLOROETHENE	91.0	86.5	5	38-155	(c)						
1,1-DICHLOROETHANE	107.0	99.0	7	47-132	(c)				FIELD DUPLICATE PRECISION: NO FIELD DUPLICATES WERE COLLECTED		
CHLOROFORM	115.0	113.0	1	49-133	(c)						
1,2-DICHLOROETHANE	113.5	115.5	-1	51-147	(c)						
1,1,1-TRICHLOROETHANE	108.0	105.5	2	41-138	(c)						
CARBON TETRACHLORIDE	114.5	110.5	3	43-143	(c)						
1,2-DICHLOROPROPANE	116.5	112.0	3	44-156	(c)						
TRICHLOROETHENE/	107.5	104.3	3	35-146	(c)						
BROMODICHLOROMETHA	107.5	104.3	3	42-172	(c)						
c-1,3-DICHLOROPROPENE	116.0	111.0	4	22-178	(c)						
1,1,3-DICHLOROPROPENE	118.0	108.5	8	22-178	(c)						
1,1,2-TRICHLOROETHANE	125.5	122.0	2	39-136	(c)						
DI(BROMOCHLOROMETHAN	125.5	115.5	8	24-191	(c)						
TETRA(CHLOROETHENE	112.0	118.5	-5	26-162	(c)						
BROMOFORM	116.0	113.0	2	13-159	(c)						
1122-TETRACHLOROETHA	126.5	130.5	-3	8-184	(c)						
TERT-BUTYL METHYL ETH	158.3	127.0	21	(c)							
BENZENE	97.0	98.0	-1	39-150	(c)						
TOLUENE	103.4	104.0	0	46-148	(c)						
CHLOROBENZENE	96.0	102.0	-6	55-135	(c)						
ETHYL BENZENE	96.5	105.0	-8	32-160	(c)						
mp-XYLENE	109.0	116.5	-6	(c)							
o-XYLENE	107.5	114.5	-6	(c)							
1,3-DICHLOROBENZENE	82.5	82.5	0	50-141	(c)						
1,4-DICHLOROBENZENE	83.0	87.5	-5	42-143	(c)						
1,2-DICHLOROBENZENE	82.5	92.0	-10	37-154	(c)						
SAMPLE = 73770 SPIKE LEVEL = 100 ug/l (a) BCM - BROMOCHLOROMETHANE (65-135) (b) TFT - A,A,A-TRIFLUOROTOLUENE (65-135) (c) NO ESTABLISHED CRITERIA											

TABLE 2.5: QA/QC DATA FOR THE PURGEABLE HALOCARBONS AND AROMATIC COMPOUNDS ANALYSIS – EPA METHODS 601/602

MATRIX CASE NUMBER LABORATORY	MS/MSD ACCURACY and PRECISION DATA										GENERAL QA/QC									
	MATRIX SPIKE COMPOUND		RECOVERY MS MSD		RPD (%)		RANGES REC. RPD		INITIAL CALIBRATION: GC#1; ALL ICAL CRITERIA MET GC#2; ALL ICAL CRITERIA MET		GENERAL COMMENTS:		INITIAL CALIBRATION: GC#1; ALL ICAL CRITERIA MET GC#2; ALL ICAL CRITERIA MET		CONTINUING CALIBRATION: GC#1; CCAL CRITERIA MET. EXCEPT: CH3Cl (67%, 12/10/89) GC#2; CCAL CRITERIA MET. EXCEPT: VC (55%, 12/06/89)		FIELD DUPLICATE PRECISION: NO FIELD DUPLICATES WERE COLLECTED			
11 LOW WATERS 73861 CH2M HILL/GAINSVILLE FL																				
CHLOROMETHANE	86.0	63.5	30	D-193	NA															
VINYL CHLORIDE	88.1	75.8	15	28-163	NA															
BROMOMETHANE	86.9	80.9	7	D-144	NA															
CHLOROETHANE	88.4	84.5	4	46-137	NA															
1,1-DICHLOROETHENE	68.3	70.0	-2	28-167	NA															
METHYLENE CHLORIDE	65.3	68.5	-4	25-162	NA															
t-1,2-DICHLOROETHENE	82.4	84.7	-2	38-155	NA															
1,1-DICHLOROETHANE	82.5	83.5	-1	47-132	NA															
CHLOROFORM	91.1	88.5	2	49-133	NA															
1,1,1-TRICHLOROETHANE	88.3	85.0	3	41-138	NA															
CARBON TETRACHLORIDE	94.2	91.6	2	43-143	NA															
1,2-DICHLOROETHANE	88.5	88.9	0	51-147	NA															
TRICHLOROETHENE	101.0	98.5	2	35-146	NA															
1,2-DICHLOROPROpane	97.2	94.6	2	44-156	NA															
BROMODICHLOROMETHAN	101.9	88.9	13	42-172	NA															
c-1,3-DICHLOROPROPENE	96.8	89.4	7	22-178	NA															
t-1,3-DICHLOROPROPENE	96.9	96.1	0	22-178	NA															
1,1,2-TRICHLOROETHANE	98.1	101.6	-3	39-136	NA															
TETRACHLOROETHENE	100.8	102.1	-1	26-162	NA															
DIBROMOCHLOROMETHAN	101.7	102.7	0	24-191	NA															
BROMOFORM	101.1	103.4	-2	13-159	NA															
1,122-TETRACHLOROETHA	115.9	120.3	-3	8-184	NA															
TERT-BUTYL METHYL ETH	104.6	102.2	2	(c)	NA															
BENZENE	88.4	87.8	0	39-150	NA															
TOLUENE	95.6	96.5	0	46-148	NA															
CHLOROBENZENE	99.3	100.6	-1	55-135	NA															
ETHYL BENZENE	100.2	101.1	0	32-160	NA															
mp-XYLENE	101.6	100.8	0	(c)	NA															
c-XYLENE	102.7	102.4	0	(c)	NA															
1,3-DICHLOROBENZENE	107.0	106.7	0	50-141	NA															
1,4-DICHLOROBENZENE	108.5	105.8	2	42-143	NA															
1,2-DICHLOROBENZENE	107.3	107.9	0	37-154	NA															

SAMPLE = 73861

SPIKE LEVEL = 100  $\mu$ g/L

(a) BCM – BROMOCHLOROMETHANE (65-135)  
(c) NO ESTABLISHED CRITERIA

(b) TFT – A,A,A-TRIFLUOROTOLUENE (65-135)

(c) NO CONTAMINANTS FOUND

GENERAL COMMENTS:  
BLANK CONTAMINATION,  
SAMPLE SPECIFIC FLAGS

LAB NUMBER	SITE IDENTIFICATION	(a)	SURR REC (%)	INT	CONTAMIN.	METHOD	No. OF	GENERAL COMMENTS, BLANK CONTAMINATION, SAMPLE SPECIFIC FLAGS	
			BCM	TFT	HOLDING TIME	STD	BLANK	CMFDs	TIC
			(b)	TAKEN	ANAL	—	ID		TIC
73861	7-GW-WP5A	110.0	103.0	12/01	12/06	NA	N	2VB1206A	0
73862	7-GW-WP2A	100.5	100.0	12/01	12/06	NA	N	2VB1206A	0
73863	3W-GW-WP5A	105.0	101.0	12/01	12/06	NA	N	2VB1206A	0
73864	DG1-SW	95.0	100.0	12/01	12/06	NA	N	2VB1206A	0
73865	DG2-SW	103.0	99.0	12/01	12/06	NA	N	2VB1206A	0
73866	2-GW-WP13	108.0	98.0	12/01	12/07	NA	N	2VB1206A	1
73867	POTABLE DECON	97.0	101.0	12/01	12/07	NA	N	2VB1206A	3
73868	2-GW-WP12	106.0	104.0	12/01	12/07	NA	N	2VB1206A	0
73869	BAILER BLANK	110.0	101.0	12/01	12/07	NA	N	2VB1206A	0
73870	FIELD BLANK	109.0	96.0	12/01	12/07	NA	N	2VB1206A	0
73871	TRIP BLANK	106.0	101.0	12/01	12/07	NA	N	2VB1206A	0
73861MS	7-GW-WP5A MS	110.0	98.8	NA	12/07	NA	N	2VB1206A	0
73861MSD	7-GW-WP5A MSD	107.0	98.2	NA	12/07	NA	N	2VB1206A	0
2VB1206A	NA	87.0	98.0	NA	12/06	NA	N	NA	0
1VB1210A	NA	115.0	115.0	NA	12/10	NA	N	NA	0

TABLE 2.6: QA/QC DATA FOR THE PURGEABLE HALOCARBONS AND AROMATIC COMPOUNDS ANALYSIS - EPA METHODS 601/602

MATRIX	18 LOW WATERS																				
CASE NUMBER	73952																				
LABORATORY	CH2M Hill/GAINSVILLE FL																				
MS/MSD ACCURACY and PRECISION DATA																					
MATRIX SPIKE COMPOUND		RECOVERY	RPD	RANGES																	
		MS	MSD	(%)	REC.	RPD															
CHLOROMETHANE	42.9	73.9	-53	D-193	NA																
VINYL CHLORIDE	79.7	104.1	-26	28-163	NA																
BROMOMETHANE	73.8	86.2	-15	D-144	NA																
CHLOROETHANE	70.7	102.0	-36	46-137	NA																
1,1-DICHLOROETHENE	105.3	91.8	13	28-167	NA																
METHYLENE CHLORIDE	122.3	115.6	5	25-162	NA																
t-1,2-DICHLOROETHENE	100.7	107.3	-6	38-155	NA																
1,1-DICHLOROETHANE	99.8	102.2	-2	47-132	NA																
CHLOROFORM	103.1	98.4	4	49-133	NA																
1,1,1-TRICHLOROETHANE	102.2	104.6	-2	41-138	NA																
CARBON TETRACHLORIDE	101.4	101.0	0	43-143	NA																
1,2-DICHLOROETHANE	113.3	112.4	0	51-147	NA																
TRICHLOROETHANE	113.5	111.0	2	35-146	NA																
1,2-DICHLOROPROPANE	97.3	97.8	0	44-156	NA																
BROMODICHLOROMETHANE	96.0	100.6	-4	42-172	NA																
o-1,3-DICHLOROPROPENE	90.5	92.3	-1	22-178	NA																
t-1,3-DICHLOROPROPENE	92.1	93.8	-1	22-178	NA																
1,1,2-TRICHLOROETHANE	99.3	102.8	-3	39-136	NA																
TETRACHLOROETHENE	121.9	122.8	0	26-162	NA																
DIBROMOCHLOROMETHANE	94.4	97.9	-3	24-191	NA																
BROMOFORM	90.2	98.9	-9	13-159	NA																
11,22-TETRACHLOROETHAN	95.8	106.4	-10	8-184	NA																
TERT-BUTYL METHYL ETHE	87.9	95.9	-8	(c)	NA																
BENZENE	103.4	103.9	0	39-150	NA																
TOLUENE	101.9	102.2	0	46-148	NA																
CHLOROBENZENE	97.1	98.8	-1	55-135	NA																
ETHYL BENZENE	100.0	100.2	0	32-160	NA																
mp-XYLENE	101.4	101.7	0	(c)	NA																
o-XYLENE	98.1	98.6	0	(c)	NA																
1,3-DICHLOROBENZENE	98.8	101.4	-2	50-141	NA																
1,4-DICHLOROBENZENE	100.2	101.0	0	42-143	NA																
1,2-DICHLOROBENZENE	98.3	98.9	0	37-154	NA																

SAMPLE = 73955  
SPIKE LEVEL = 100 ug/L

(a) BOM - BROMOCHLOROMETHANE (65-135)  
(c) NO ESTABLISHED CRITERIA

(b) TFT - A,A,A,TRIFLUOROTOLUENE (65-135)

## **TECHNICAL MEMORANDUM**

Page 6

February 2, 1990  
GNV27267.JX.RI

using dual photoionizing and electrolytic conductivity detectors. Because of this modification the QA/QC data are described together.

Trip blanks were submitted with the field samples. The trip blank consists of ASTM Type II water that is prepared in the laboratory prior to the sampling event. The water is stored in VOA bottles, remains closed in the field, and travels back to the laboratory with the other VOA GC and GC/MS samples. The blank indicates possible contamination introduced during the shipping, handling and storage of the samples. The usual frequency is one trip blank per shipping container.

No surrogate recovery control limits are established for this method; therefore, the performing laboratory uses its surrogate recovery control charts to establish control limits.

The decontamination water used for primary equipment wash was contaminated with bromodichloromethane, dibromochloromethane, and chloroform. No qualification of the data set was applied because the decontamination water was not used in the final step of equipment decontamination.

Table 2.4 summarizes the QA/QC data for four low concentration soil samples. The laboratory narrative described problems with chloroform contamination at levels less than 2 ppb although chloroform was not found in the daily method blank analysis. Due to the potential presence of the contaminant, all samples reporting chloroform less than 20 ppb were flagged "B."

Continuing calibration percent difference criteria were not met for chloroform (62 percent) or methylene chloride (25 percent, December 6). Because chloroform and methylene chloride were not found in any of the samples there was no further qualification. All other QA/QC measures were met and the data are acceptable.

Table 2.5 summarizes the QA/QC data for 11 low concentration water samples. All QA/QC measures were met, and the data are acceptable.

Table 2.6 summarizes the QA/QC data for 18 low concentration water samples.

Sample 73957 (Potable Decon Water C.E.4) contained chloroform (19 µg/l), dichlorobromomethane (7.6 µg/l), and dibromochloromethane (2.9 µg/l). The potable decontamination water was contaminated, as discussed above, but all other QA/QC measures were met and the data are acceptable for use.

## **TECHNICAL MEMORANDUM**

Page 7  
February 2, 1990  
GNV27267.JX.RI

### **2.2.5 Polynuclear Aromatic Hydrocarbons**

No specific surrogate or matrix spike compounds are required in the method. The compounds reported are PNA compounds or representative of the PAH group of compounds and are, therefore, appropriate. Acceptance ranges for matrix spike and surrogate recoveries are selected from EPA Method 8270. No acceptance ranges for MS/MSD precision are established. The reviewer used professional judgment to evaluate precision.

Table 2.7 summarizes the QA/QC data for 12 low concentration water samples. All QA/QC measures were met, and the data are acceptable.

## **3.0 WET CHEMISTRY**

Samples analyzed by wet chemistry methods do not have format-specific deliverables. The data review consisted of checking that the following QA/QC was performed and acceptable: initial calibration or calibration verification, MS/MSD, laboratory blank, blank spike, and control charts.

Table 3.1 summarizes the TSS data for two low concentration water samples. Table 3.2 summarizes the total hardness data for the same samples. All QA/QC measures were met, and the data are acceptable.

## **4.0 METALS ANALYSES**

### **4.1 INTRODUCTION**

Metal analyses data were reviewed and validated using HAZWRAP Level C Data Validation Guidelines and supplemented using the guidance document "Laboratory Data Validation Functional Guidelines for Evaluating Inorganic Analyses" [6]. The required data deliverables, as specified under Level C, are laboratory control charts and forms used in the CLP SOW. The forms summarize the raw, experimental data.

**Form I--Data Sheet** presents the sample results and is reviewed for completeness.

**Form IIA--Initial and Continuing Calibration Verification** is used to report analyte recoveries from calibration solutions. Initial calibration data demonstrate that the analytical instrument is performing satisfactorily and is capable of producing acceptable quantitative data at the beginning of the analytical period.

TABLE 2.7: QA/QC DATA FOR THE POLYNUCLEAR AROMATIC COMPOUND ANALYSIS – EPA METHOD 610

MATRIX		CASE NUMBER		LABORATORY		MS/MSD ACCURACY and PRECISION DATA		GENERAL QA/QC		GENERAL COMMENTS:	
MATRIX SPIKE COMPOUND	RECOVERY (%)	MS	MSD	RPD (%)	RANGES REC. (RPD)	GC/MS TUNING: NO INFORMATION PROVIDED					
NAPHTHALENE	66	69	—	4	NA	NA					
ACENAPHTHYLENE	87	85	—	2	NA	NA					
PYRENE	91	92	—	1	NA	NA					
INITIAL CALIBRATION: ALL MEAN RRF AND %RSD CRITERIA MET											
CONTINUING CALIBRATION: ALL MEAN RRF AND %D CRITERIA MET											
SAMPLE = 14964006 SPIKE LEVEL = 100 UG/L											
SAMPLE SPECIFIC QA/QC DATA											
LAB NUMBER	SITE IDENTIFICATION	TPH (a)	—	—	—	—	TAKEN	EXT ANAL	INTERNAL STANDARD PERFORMANCE (%)	CONTAMINANT MTH FLD (Y/N)	METHOD BLANK CMPD# ID TIC
14964001	7-GW-WP5A	105	NA	NA	NA	NA	12/01	12/06	12/16	NA	NA C12059B1 0 NA
14964002	7-GW-WP2A	102	NA	NA	NA	NA	12/01	12/06	12/16	NA	NA C12059B1 0 NA
14964003	3W-GW-WP5A	94	NA	NA	NA	NA	12/01	12/06	12/16	NA	NA C12059B1 0 NA
14964004	DG1-SW	102	NA	NA	NA	NA	12/01	12/06	12/16	NA	NA C12059B1 0 NA
14964005	DG2-SW	98	NA	NA	NA	NA	12/01	12/06	12/16	NA	NA C12059B1 0 NA
14964006	POT DECON WATE	60	NA	NA	NA	NA	12/01	12/06	12/16	NA	NA C12059B1 0 NA
14964007	BAILER BLANK	105	NA	NA	NA	NA	12/01	12/06	12/16	NA	NA C12059B1 0 NA
14964008	FIELD BLANK	104	NA	NA	NA	NA	12/01	12/06	12/16	NA	NA C12059B1 0 NA
C12059B1	QC BLANK	98	NA	NA	NA	NA	NA	NA	12/16	NA	NA C12059B1 0 NA
14964006	POT DECON-MS	100	NA	NA	NA	NA	NA	NA	12/16	NA	NA C12059B1 0 NA
14964006	POT DECON-MSD	104	NA	NA	NA	NA	NA	NA	12/16	NA	NA C12059B1 0 NA
14988001	B-GW-MW3	102	NA	NA	NA	NA	12/05	12/11	12/16	NA	NA N C12119B1 0 NA
14988002	B-GW-MW2	100	NA	NA	NA	NA	12/05	12/11	12/16	NA	NA N C12119B1 0 NA
14988003	B-GW-MW1	106	NA	NA	NA	NA	12/05	12/11	12/16	NA	NA N C12119B1 0 NA
14988004	B-GW-MW4	100	NA	NA	NA	NA	12/05	12/11	12/16	NA	NA N C12119B1 0 NA
14988005	BAILER BLANK #3	100	NA	NA	NA	NA	12/05	12/11	12/16	NA	NA N C12119B1 0 NA
14988006	POT DECON C.E.4	108	NA	NA	NA	NA	12/05	12/11	12/16	NA	NA N C12119B1 0 NA
C12119B1	QC BLANK	108	NA	NA	NA	NA	NA	NA	12/16	NA	NA N C12119B1 0 NA

(a) TPH – TERPHENYL (65–135%)

TABLE 3.1: QA/QC DATA FOR THE TOTAL HARDNESS ANALYSIS – EPA METHOD 130.2

MATRIX	2 LOW WATERS					
CASE NUMBER	73952 to 73972					
LABORATORY	CH2M HILL/GAINSVILLE FL					
MS/MSD/ACCURACY and PRECISION DATA						
	RECOVER	RPD	RANGES			
MATRIX SPIKE COMPOUND	MS	MSD	(%)	REC.	RPD	
TOTAL HARDNESS	98.5	98.5	0	65–135	NA	
SAMPLE = 1-GW-MW2 SPIKE LEVEL = 100 MG/L	FLAG: NONE					
SAMPLE SPECIFIC QA/QC DATA						
LAB NUMBER	SITE IDENTIFICATION			HOLDING TIME		GENERAL COMMENTS, BLANK CONTAMINATION, SAMPLE SPECIFIC FLAGS
		TAKEN	EXT	ANAL	MTH FLD (Y/N)	METHOD BLANK ID
73952	3E-GW-MW1	12/04	NA	12/12	N	N
73956	1-GW-MW2	12/05	NA	12/12	N	N
NA	METHOD BLANK	NA	NA	12/12	N	N
						METHOD BLANK < 1.0 mg/L

TABLE 3.2: QA/QC DATA FOR THE TOTAL SUSPENDED SOLIDS ANALYSIS – EPA METHOD 160.2

MATRIX	2 LOW WATERS				
CASE NUMBER	73952 to 73972				
LABORATORY	CH2M HILL/GAINSVILLE FL				
<b>SAMPLE DUPLICATE PRECISION DATA</b>					
SAMPLE COMPOUND	CONC.	RPD (%)	RANGES RPD		
TSS	264	302	13.4		
			NA		
<b>GENERAL QA/QC</b>					
GENERAL COMMENTS:		METHOD PERFORMANCE: INITIAL CALIBRATION BLANK (<1.0 mg/L)			
INITIAL CALIBRATION:		CONTINUING CALIBRATION:			
		FIELD DUPLICATE PRECISION: NO FIELD DUPLICATE COLLECTED			
SAMPLE = 1-GW-MW2					
<b>SAMPLE SPECIFIC QA/QC DATA</b>					
LAB NUMBER	SITE IDENTIFICATION	HOLDING TIME	CONTAMINANT		
		TAKEN EXT ANAL	MTH FLD BLANK ID (Y/N)		
73952	3E-GW-MW1	12/04 NA	N N METHOD BLANK		
73956	1-GW-MW2	12/05 NA	N N METHOD BLANK		
NA	METHOD BLANK	NA	N N METHOD BLANK < 1.0 mg/L		

**TECHNICAL MEMORANDUM**

Page 8

February 2, 1990  
GNV27267.JX.RI

Continuing calibration checks document that the instrument continues to produce acceptable data. Calibration spike recoveries must fall within a tight acceptance window for analysis to begin or continue.

**Form IIB--CRDL Standard for AA and ICP** is used to report analyte recoveries from analyses of the Contract Required Detection Limits (CRDL) standards for AA and ICP. The laboratory analyzes a standard solution that is twice the Instrument Detection Limit (IDL) to verify the linearity of the instrument at low detection limits.

**Form III--Blanks** is used to report analyte concentrations detected in the Initial Calibration Blank (ICB), Continuing Calibration Blanks (CCB), and the Preparation Blank (PB). Method blanks are used to monitor the existence and magnitude of contamination problems. If problems with any blank exist, all data associated with that sample delivery group must be carefully evaluated to determine if there is a problem with the entire analytical group or if it is an isolated incident.

**Form IV--ICP Interference Check Sample (ICS)** is used to report ICS results for each ICP instrument used. The ICS is a mixture of analytes that have a potential for interference and is performed to verify the laboratory's interelement and background correction factors.

**Form VA--Spike Sample Recovery** is used to report results for the pre-digestion spike recovery. This spike recovery measurement is analogous to the MS/MSD spike recovery for organic analyses in that it measures the effects of the sample matrix on the recovery of a known quantity of analyte. Additionally, it also measures the efficiency of the digestion process. If the pre-digestion spike recovery does not fall within preset limits (usually 75 to 125 percent), then a post-digestion spike is added and the sample reanalyzed.

**Form VB--Post-Digestion Spike Sample Recovery** is used to report recovery results for the above mentioned post-digestion spike. Again, the established acceptance limit for recovery is 75 to 125 percent. If both the pre- and post-digestion spike recovery is outside the acceptance limits, this is considered positive evidence of matrix interferences, and the data are flagged "J."

**Form VI--Duplicates** is used to report the results of duplicate laboratory analysis rather than a field duplicate. This duplicate differs from the MSD used in organic analyses in that the analyte concentration measured is native to the sample rather than that which has been added (spiked). Duplicate analyses are required for calculating percent solids (for soil samples) and all analyte results.

## **TECHNICAL MEMORANDUM**

Page 9

February 2, 1990

GNV27267.JX.RI

Duplicate data are used to calculate precision for all analyte concentrations greater than five times the CRDL. Acceptance limits are set at 0 to 20 percent.

**Form VII--Laboratory Control Sample (LCS)** is used to report the recovery results for the standard LCS. The LCS analysis is designed to serve as a monitor of the efficiency of the digestion procedure, and analyte recoveries must fall within acceptance limits (usually 90 to 110 percent).

**Form VIII--Standard Addition Results** is used to report the results of samples analyzed using the Method of Standard Additions and is only used for Graphite Furnace Atomic Absorption Analysis. Duplicate injections and furnace post-digestion spike recoveries are used to establish the precision and accuracy of the individual analytical determinations. For all analyte concentrations greater than 5 times the CRDL, acceptance limits of 0 to 20 percent relative standard difference have been established in the CLP SOW.

**Form IX--ICP Serial Dilution** is used to report results for ICP serial dilution which determines whether significant physical or chemical interferences exist due to sample matrix effects. For any analyte whose concentration is 50 times greater than the IDL, the sample is diluted and the results compared (diluted versus undiluted) for agreement (precision).

**Form X--Holding Times** is used to report holding times for mercury (28 days) and cyanide (14 days). Samples that are not analyzed within the holding times are flagged "L" to indicate low bias.

**Form XI--Instrument Detection Limits (Quarterly)** documents the quarterly IDL study conducted by the laboratory for each instrument used to produce the data package. Additionally, the raw experimental and supporting documentation are reviewed thoroughly for analyte quantitation and reported detection limits, strip chart recordings, and instrument data system printouts.

### **4.2 INORGANIC DATA VALIDATION SUMMARY TABLES**

Each table presents the validation information for one sample delivery group and sample matrix. Data nonconformances are flagged and the nonconformance is discussed in the corresponding text section. The flags are also included on the data summary tables so that the possible limitations of data quality will be considered before the data is used to support project decisions. Control limits are delineated in the appropriate method or utilized from the CLP SOW [6] when the method does not have established control limits. The text is organized by sample delivery groups.

## **TECHNICAL MEMORANDUM**

Page 10

February 2, 1990

GNV27267.JX.RI

The summary tables for a given analytical method are presented by laboratory number (in ascending sequential order). The data validation summary tables are discussed by category below in the same order that they appear.

The holding times reported for mercury analysis are acceptable. No holding times were reported for the remaining elements, which are assumed to be met because the data reporting date preceded holding time expiration.

Table 4.1 summarizes the QA/QC data for 10 low concentration water samples.

Matrix spike recovery for selenium (70.5 percent) was below acceptance criteria and flagged "L." The post spike recovery was within criteria. The reported concentration and quantitation limit for selenium is estimated in all samples. No samples reported selenium concentrations greater than the CRDL. The preparation blank contains barium (2.0  $\mu\text{g/l}$ ) and lead (1.7  $\mu\text{g/l}$ ). Samples containing these elements at concentrations less than five times the amount in the preparation blank are flagged "B."

Table 4.2 summarizes the QA/QC data for 13 low concentration soil samples.

Matrix spike recovery for arsenic (70.4 percent) was below acceptance criteria and flagged "L." The post spike recovery was within criteria. The reported concentration and quantitation limit for arsenic is estimated in all samples. No samples reported arsenic concentrations greater than the CRDL. All other QA/QC measures were met, and the data are acceptable.

Table 4.3 summarizes the QA/QC data for nine low concentration water samples.

Matrix spike recoveries were performed on samples 14996003 and 14996006. In sample 14996003 the matrix spike contained lead and the recovery was acceptable. In sample 14996006 the matrix spike contained iron and lead. Spike recovery was above acceptance criteria and flagged "K" for iron (596.5 percent), was below acceptance criteria and flagged "L" for lead (58.2 percent). The native concentration of iron exceeded the amount of iron added as a spike and contributed to the poor recovery. The laboratory report also cites that the sample contained large amounts of solids/sediments. A post spike was performed at an appropriate spike concentration, and the recovery for iron and lead was within criteria. Only the iron and lead concentrations in sample 14996006 were flagged on the basis of matrix spike recoveries.

The preparation blank contained iron (50.1  $\mu\text{g/l}$ ). Samples containing iron at concentrations less than five times the amount in the preparation blank were flagged "B."

TABLE 4.1; QA/QC DATA FOR SELECTED INORGANIC METALS ANALYSIS

MATRIX : 10 LOW WATERS  
 CASE NUMBER : 14969  
 LABORATORY : CH2M Hill/MONTGOMERY AL

PERFORMANCE QA/QC											
INITIAL CALIBRATION					ICAL BLANK						
MULTIPOINT CALIBRATION NOT PROVIDED					ICAL 1; Cd(-1.9 ug/l)						
ICAL VERIFICATION MET CRITERIA											
CONTINUING CALIBRATION					PREP BLANK						
CCAL VERIFICATION MET CRITERIA					Ba(2.0 ug/l), Pb(1.7 ug/l) Se(-1.1 ug/l)						
INTERFERENCE CHECK SAMPLE					CONTINUING BLANK						
ICS MET CRITERIA					CCAL 1-2; Cd(1.9 ug/l), Cr(-5.9 ug/l)						
ELEMENT	METHOD	CRDL (ug/l)	IDL (ug/l)	LCS RECOVERY		SPIKE RECOVERY (%)			DUP. PRECISION	SER.DIL.	PREP BLK
				(%)	LIMIT	PRE	LIMIT	POST	(%RPD)	LIMIT	(%D)
ARSENIC	GFAA	10	0.3	107.1	80-120	98.4	75-125	110.4	NA	+/-20%	NA
BARIUM	ICP	200	0.8	98.7	80-120	100.9	75-125	NA	2.7	+/-20%	NA
CADMIUM	ICP	5	1.6	92.5	80-120	88.5	75-125	NA	NA	+/-20%	NA
CHROMIUM	ICP	10	5.5	93.0	80-120	97.7	75-125	NA	NA	+/-20%	NA
LEAD	GFAA	5	0.9	96.9	80-120	97.4	75-125	111.5	NA	+/-20%	NA
MERCURY	CV	0.2	0.2	99.6	80-120	118.4	75-125	NA	NA	+/-20%	NA
SELENIUM	GFAA	5	1.1	88.5	80-120	70.5	75-125	103.6	NA	+/-20%	NA
SILVER	ICP	10	6.7	94.5	80-120	83.5	75-125	NA	NA	+/-20%	NA
SAMPLE QA/QC											
LAB NUMBER	SITE IDENTIFICATION	SAMPLE TAKEN	HOLDING TIME			CONTAMINANT		GENERAL COMMENTS			
			HG PREP	CN-	OTHERS	FLD (Y/N)	PREP (Y/N)	BLANK CONTAMINATION SAMPLE SPECIFIC FLAGS			
14969001	6-GW-MW1	12/01	NA	NA	NA	N	N				
14969002	6-GW-MW2	12/01	NA	NA	NA	N	N				
14969003	7-GW-WP5A	12/01	NA	NA	NA	N	Y	Pb flagged B			
14969004	7-GW-WP2A	12/01	NA	NA	NA	N	Y	Pb flagged B			
14969005	3W-GW-WP5A	12/01	NA	NA	NA	N	N				
14969006	DG1-SW	12/01	12/11	NA	NA	N	N				
14969007	DG2-SW	12/01	12/11	NA	NA	N	Y	Pb flagged B			
14969008	POTABLE DECON WATER	12/01	12/11	NA	NA	N	Y	Pb flagged B			
14969009	BAILER BLANK	12/01	12/11	NA	NA	N	N				
14969010	FIELD BLANK	12/01	12/11	NA	NA	N	N				

TABLE 4.2; QA/QC DATA FOR SELECTED INORGANIC METALS ANALYSIS

MATRIX : 13 LOW SOILS  
 CASE NUMBER : 14969  
 LABORATORY : CH2M Hill/MONTGOMERY AL

PERFORMANCE QA/QC												
INITIAL CALIBRATION					ICAL BLANK							
MULTIPOINT CALIBRATION NOT PROVIDED					Cd (-1.9 ug/l)							
ICAL VERIFICATION MET CRITERIA												
CONTINUING CALIBRATION					PREP BLANK							
CCAL VERIFICATION MET CRITERIA												
INTERFERENCE CHECK SAMPLE					CONTINUING BLANK							
ICS MET CRITERIA					CBLK 1-2; Ca (-2.4 ug/l) CBLK 2-1; Ca (3.4 ug/l)							
SELECTED ELEMENT	METHOD	CRDL (mg/Kg)	IDL (ug/l)	LCS RECOVERY		SPIKE RECOVERY (%)			DUP. PRECISION		SER.DIL. (%D)	PREP BLK (mg/Kg)
				(%)	LIMIT	PRE	LIMIT	POST	(%RPD)	LIMIT		
ARSENIC	GFAA	1	0.3	75.7	80-120	70.4	75-125	100.0	19.8	+/-35%	NA	NA
BARIUM	ICP	20	0.8	106.2	80-120	94.3	75-125	NA	19.9	+/-35%	NA	0.002
CADMIUM	ICP	5	1.6	80.0	80-120	92.8	75-125	NA	NA	+/-35%	NA	0.002
CHROMIUM	ICP	10	5.5	88.4	80-120	97.0	75-125	NA	9.9	+/-35%	NA	NA
LEAD	GFAA	0.5	9	95.6	80-120	98.9	75-125	112.0	33.4	+/-35%	NA	0.174
MERCURY	CV	0.02	0.2	90.6	80-120	85.3	75-125	NA	—	+/-35%	NA	NA
SELENIUM	GFAA	0.5	1.1	61.5	80-120	78.4	75-125	98.0	—	+/-35%	NA	-0.113
SILVER	ICP	1	6.7	84.2	80-120	76.7	75-125	NA	—	+/-35%	NA	NA
SAMPLE QA/QC												
LAB NUMBER	SITE IDENTIFICATION	SAMPLE TAKEN	HOLDING TIME			CONTAMINANT		GENERAL COMMENTS				
			HG PREP	CN-	OTHERS	FLD (Y/N)	PREP (Y/N)	BLANK CONTAMINATION	SAMPLE SPECIFIC FLAGS			
14969011	8-SL-MW3-1 (1-3')	11/28	NA	NA	NA	N	N					
14969012	8-SL-MW3-2 (3-5')	11/28	NA	NA	NA	N	N					
14969013	8-SL-MW2-1 (1-3')	11/28	NA	NA	NA	N	N					
14969014	8-SL-MW2-2 (3-5')	11/28	NA	NA	NA	N	N					
14969015	8-SL-MW1-1 (1-3')	11/28	NA	NA	NA	N	N					
14969016	8-SL-MW4-1 (1-3')	11/28	NA	NA	NA	N	N					
14969017	8-SL-MW1-2 (3-5')	11/28	NA	NA	NA	N	N					
14969018	8-SL-SB5-1 (1-3')	11/28	NA	NA	NA	N	N					
14969019	8-SL-SB5-2 (3-5')	11/28	NA	NA	NA	N	N					
14969020	BK-SL-1 (1-2')	11/28	12/11	NA	NA	N	N					
14969021	BK-SD-1	11/28	12/11	NA	NA	N	N					
14969022	DG1-SD-1	11/28	12/11	NA	NA	N	N					
14969023	DG2-SD-1	11/28	12/11	NA	NA	N	N					

TABLE 4.3; QA/QC DATA FOR SELECTED INORGANIC METALS ANALYSIS

MATRIX : 9 LOW WATERS

CASE NUMBER : 14996

LABORATORY : CH2M HILL/MOMTGOMERY AL

PERFORMANCE QA/QC											
INITIAL CALIBRATION					ICAL BLANK						
MULTIPOINT ICAL NOT PROVIDED					NONE						
ICAL VERIFICATION MET CRITERIA											
CONTINUING CALIBRATION					PREP BLANK						
CCAL VERIFICATION MET CRITERIA					Pb (50.1 ug/l)						
INTERFERENCE CHECK SAMPLE					CONTINUING BLANK						
ICS MET CRITERIA					NONE						
ELEMENT	METHOD	CRDL (ug/l)	IDL (ug/l)	LCS RECOVERY		SPIKE RECOVERY (%)			DUP. PRECISION	SER.DIL.	PREP BLK
				(%)	LIMIT	PRE	LIMIT	POST	(%RPD)	LIMIT	(%D)
CHROMIUM	ICP	10	5.5	92.1	80-120	105.0	75-125	95.3	23.3	+/-20%	NA
IRON	GFAA	100	25.0	92.3	80-120	596.5	75-125	96.4	20.2	+/-20%	NA
LEAD	GFAA	5	9	105.5	80-120	58/ 93	75-125	106/ 97	16.1/0.0	+/-20%	NA
FLAGS											
NO YES NO NO NO NO											
SAMPLE QA/QC											
LAB NUMBER	SITE IDENTIFICATION		SAMPLE TAKEN	HOLDING TIME			CONTAMINANT		GENERAL COMMENTS		
				HG PREP	CN-	OTHERS	(Y/N)	PREP (Y/N)	BLANK CONTAMINATION		
14996001	3E-GW-MW1		12/04	NA	NA	NA	N	N			
14996002	2-GW-WP13		12/04	NA	NA	NA	N	N			
14996003	2-GW-WP12		12/04	NA	NA	NA	N	N			
14996004	TRAVEL BLANK		12/04	NA	NA	NA	N	N			
14996005	1-GW-MW1		12/05	NA	NA	NA	N	N			
14996006	1-GW-MW2		12/05	NA	NA	NA	N	N			
14996007	POTABLE DECON WATER C.E.4		12/05	NA	NA	NA	N	N			
14996008	2-GW-WP13 (FILTERED)		NA	NA	NA	NA	N	N			
14996009	2-GW-WP12 (FILTERED)		NA	NA	NA	NA	N	N			

**TECHNICAL MEMORANDUM**

Page 11

February 2, 1990

GNV27267.JX.RI

**5.0 CONCLUSIONS**

The data were reviewed and validated using HAZWRAP Level C Validation Guidelines supplemented with EPA Functional Guidelines. The data are acceptable with qualifications as noted.

**6.0 REFERENCES**

1. *Hazardous Waste Remedial Actions Program Requirements for Quality Control of Analytical Data.* August 1988.
2. U.S. EPA. *Laboratory Data Validation Functional Guidelines for Evaluating Organic Analyses.* 1988 revision.
3. U.S. EPA. *Laboratory Data Validation Functional Guidelines for Evaluating Inorganics Analyses.* 1988 revision.
4. U.S. EPA. *Contract Laboratory Program Statement of Work for Organic Analyses.* 1988 revision.
5. U.S. EPA. *Test Methods for Evaluating Solid Waste (SW-846),* Third edition. September 1986.
6. U.S. EPA. *Contract Laboratory Program Statement of Work for Inorganic Analyses.* 1988 revision.

GLT949/025.50

**TO:** Becky Svatos/GNV  
**FROM:** Ann Castleberry/MGM  
**DATE:** December 3, 1990  
**SUBJECT:** Data Validation for Jacksonville ANG Site Investigation  
**PROJECT:** GNV27267.JX.RI

This memorandum summarizes the results of the data review and validation for Sample Delivery Group 17211. Overall, the data are acceptable and can be used without any qualifications.

All the samples were analyzed within the 6-month holding time. The results are summarized below. All the total (unfiltered) results are greater than the dissolved (or unfiltered) values; after the samples were filtered, no chromium was detected above the instrument detection limit.

Field Point	Total ( $\mu\text{g/l}$ )	Dissolved ( $\mu\text{g/l}$ )
MW 6-1	9.9 B U	3.3 U
MW 6-2	19.6 U	3.3 U
WP 6-4	286	3.3 U
WP 6-5	32.6 U	3.3 U
WP 6-6	1,650	3.3 U
Equipment Blank	10.4	
Field Blank	7.2 B	
Method Blanks	3.3 U	
Duplicate Sample	3.3 U	

For inorganic results, the B qualifier means that the sample result is greater than the instrument detection limit, but less than the contract required detection limit. As a result, the chromium detected in the field blank may have minimum impact on the sample results, but the equipment blank value should be considered. As with organic results, if a target analyte is present in any blank, then the sample results may be qualified. The U.S. Environmental Protection Agency states in the *Laboratory Data Validation Functional Guidelines for Evaluating Inorganic Analyses* (1988) that:

"Action in the case of unsuitable blank results depends on the circumstances and origin of the blank. Sample results in excess

**M E M O R A N D U M**

Page 2

December 3, 1990

GNV27267.JX.RI

of the instrument detection limit but less than five times the amount in any blank should be qualified as (U)."

Multiplying the equipment blank value of 10.4 by 5 yields 52. The qualifier is, therefore, applied to three of the sample results, as indicated in the table by italicized U's.

Initial and continuing calibration verification is acceptable. Both the initial and continuing calibration sample percent recovery are within the 90 to 110 percent target recovery window.

Blanks are acceptable. No values of the target analyte were detected above the instrument detection limit.

ICP interference check sample is acceptable. Both the initial and final percent recovery are within the 80 to 120 percent target recovery window.

Pre- and post-digestion spike recoveries are acceptable. Both recoveries are within the 75 to 125 percent target recovery window.

Duplicates are duplicate laboratory samples rather than duplicate field samples. Both filtered and unfiltered samples were duplicated. As would be expected, the duplicate of the filtered sample was zero. The duplicate of the unfiltered sample was also zero (below the detection limit). This result is not unexpected, as the native sample result was less than the contract required detection limit and the samples contained sediment. Therefore, the duplicate results are acceptable and do not influence the usability of the data.

The laboratory control sample is acceptable, because the percent recovery is between the target limits of 90 to 110 percent. In regard to the control chart and the corrective action note at the end of the data package, be aware that a new ICP calibration standard (which included chromium) was prepared 10 days before this sample was analyzed. Control chart limits naturally change slightly after a new calibration standard is introduced. Since 11 data points are needed to define a control chart, and 11 new ones have not been produced using the new calibration standard, the control chart reflects the change from "old" to "new" rather than only the new calibration standard. Therefore, the laboratory control sample percent recovery for this specific sample batch may be outside the lower control limit of the control chart, but it is within the CLP target limits of 90 to 110 percent and is therefore acceptable.

**M E M O R A N D U M**

Page 3

December 3, 1990

GNV27267.JX.RI

Instrument detection limits (quarterly) are acceptable. This form simply establishes the laboratory-specific instrument detection limit for chromium. An instrument detection limit of 3.3  $\mu\text{g/l}$  was used on all the sample result forms.

ICP interelement correction factors (quarterly) are acceptable.

ICP linear ranges (quarterly) are acceptable. The form states that the sample results fall within the instrument linear range for this analysis.

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**APPENDIX G**  
*Risk Assessment Methodology*

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## Appendix G RISK ASSESSMENT METHODOLOGY

### EXPOSURE ESTIMATION

Exposure is defined as the contact of an organism with a chemical or physical agent. In this assessment, exposure is normalized for time and body weight. Exposure normalized for time and body weight is termed "intake." Chemical intake is expressed as mg chemical/kg body weight-day.

#### GENERIC ESTIMATION OF INTAKE

Equation G-1 presents a generic equation for calculating chemical intake.

$$I = (C \times CR \times EF \times ED) \div (BW \times AT) \quad (G-1)$$

where:

- I = Chemical intake (mg/kg body weight-day)
- C = Chemical concentration (e.g., mg/l)
- CR = Contact rate (e.g., liters/day)
- EF = Exposure frequency (days/year)
- ED = Exposure duration (years)
- BW = Body weight (kg)
- AT = Averaging time (days)

#### Carcinogens

A lifetime average intake (or chronic daily intake) of the chemical is estimated for carcinogens as a means of prorating the total cumulative intake over a lifetime. An averaging time of 75 years is used for carcinogens.

Intake can change over a lifetime as body weight, contact rate, exposure frequency, and chemical concentrations change. Equation G-1 can be modified to address this issue:

$$I = (1/AT) \sum_{i=1}^M (C_i \times CR_i \times EF \times ED) \div BW_i \quad (G-2)$$

where:

- I = Chronic daily intake of the chemical (mg/kg body weight-day)
- C<sub>i</sub> = Chemical concentration in i<sup>th</sup> time period (e.g., mg/l)

$CR_i$  = Contact rate in  $i^{\text{th}}$  time period (e.g., liters/day)  
 $EF_i$  = Exposure frequency in  $i^{\text{th}}$  time period (days/year)  
 $M$  = Number of time periods  
 $ED$  = Exposure duration in  $i^{\text{th}}$  time period (years)  
 $BW_i$  = Body weight in  $i^{\text{th}}$  time period (kg)  
 $AT$  = Averaging time (days)

The U.S. Environmental Protection Agency (EPA) typically assumes a constant body weight (typically 70 kilograms) in estimating lifetime cancer risk. This assumption would alter equation G-3 to yield the following:

$$I = \frac{1}{(AT+BW)} \sum_{i=1}^M (C_i \times CR_i \times EF_i \times ED) \quad (\text{G-3})$$

### Non-Carcinogens

The chemical intake of non-carcinogens is estimated over the appropriate exposure period or averaging time. The averaging time selected depends on the toxic endpoint being assessed.

When evaluating exposures to developmental toxicants, intakes are calculated by averaging over the exposure event (e.g., a day or single exposure incident). For acute toxicants, intakes are calculated by averaging over the shortest exposure period that could produce an effect, usually an exposure event or a day. For both situations, it can be assumed that the averaging time and the exposure period are equal.

Therefore, equation G-1 can be simplified to:

$$I = (C \times CR) \div (BW) \quad (\text{G-4})$$

where:

$I$  = Chemical intake (mg/kg body weight-day)  
 $C$  = Chemical concentration (e.g., mg/l)  
 $CR$  = Contact rate (e.g., liters/day)  
 $BW$  = Body weight (kg)

When evaluating exposure to non-carcinogenic systemic toxicants, intakes are calculated by averaging intakes over the period of exposure. The averaging time used is no longer than a year and may conservatively be estimated to be a day. In the latter situation, intake can be estimated using equation G-4.

## MEDIA-SPECIFIC INTAKES

The methodology for estimating intake from specific environmental media is presented in Section 6 of the draft report.

## CARCINOGENIC RISK ESTIMATION

For carcinogens, risks are estimated as the incremental probability of an individual developing cancer over a lifetime as a result of exposure to a potential carcinogen. The cancer potency factor or slope factor (SF) converts estimated daily chemical intakes averaged over a lifetime of exposure directly to incremental risk.

To estimate risks from exposure to carcinogens, the following is needed:

- Chronic daily intake of the chemical
- Carcinogenic potency factor

### ESTIMATING CANCER RISKS CAUSED BY EXPOSURE TO A SINGLE CARCINOGEN

The one-hit equation can be used to describe excess lifetime cancer risk from exposure to a carcinogen. This model can be described by the following equation:

$$\text{Risk} = 1 - \exp^{-(\text{SF} \times \text{CDI})} \quad (\text{G-5})$$

where:

- Risk = Excess lifetime cancer risk as a unitless probability  
exp = The exponential 2.71828  
SF = Slope factor or cancer potency factor ( $\text{mg}/\text{kg}\cdot\text{day}$ ) $^{-1}$   
CDI = Chronic daily intake averaged over a lifetime ( $\text{mg}/\text{kg}\cdot\text{day}$ )

Where the risks are low (risk  $< 10^{-3}$ ), it can generally be assumed that the dose-response relationship will be in the linear low-dose portion of the multi-stage model dose-response curve. Under this assumption, the slope factor is a constant and risk is directly related to intake. This can be described as:

$$\text{Risk} = \text{SF} \times \text{CDI} \quad (\text{G-6})$$

### ESTIMATING CANCER RISKS CAUSED BY EXPOSURE TO MULTIPLE CARCINOGENS

To assess the potential for carcinogenic effects posed by exposure to multiple carcinogens, it is assumed in the absence of information on synergistic or antagonistic effects that carcinogenic risks are additive. This approach is based on EPA's

*Guidelines for Health Risk Assessment of Chemical Mixtures* (1986) and *Guidelines for Cancer Risk Assessment* (1986).

For estimating cancer risks from exposure to multiple carcinogens from a single exposure route, the following equation is used:

$$\text{Risk}_T = \sum_{i=1}^N \text{Risk}_i \quad (G-7)$$

where:

$\text{Risk}_T$  = Total cancer risk from route of exposure  
 $\text{Risk}_i$  = Cancer risk for the  $i^{\text{th}}$  chemical

## NON-CARCINOGENIC RISK ESTIMATION

### COMPARISON OF INTAKE TO REFERENCE DOSE

The potential for non-carcinogenic health effects from exposure to a contaminant is evaluated by comparing an exposure level over a specified time period with a reference dose for a similar time period. This ratio of exposure to toxicity is called a hazard quotient and is described below:

$$HQ = E + RfD \quad (G-8)$$

where:

$HQ$  = Noncancer hazard quotient  
 $E$  = Exposure level (or intake in mg/kg-day)  
 $RfD$  = Reference dose (mg/kg-day)

This comparison can be interpreted as follows:

$$HQ \geq 1 \text{ Potential for health effects} \quad (G-9)$$

$$HQ < 1 \text{ Health effects not anticipated} \quad (G-10)$$

### HAZARD INDEX APPROACH

Exposure situations may involve the potential exposure to more than one chemical. To assess the potential for non-carcinogenic effects posed by multiple chemicals, a hazard index (HI) approach can be used. This approach, which is based on EPA's *Guidelines for Health Risk Assessment of Chemical Mixtures* (1986), assumes dose

additivity and sums the ratios of the daily intakes of individual chemicals to their reference doses, as shown below:

$$HI = E_1/RfD_1 + E_2/RfD_2 + \dots E_i/RfD_i \quad (G-11)$$

where:

HI = Hazard index

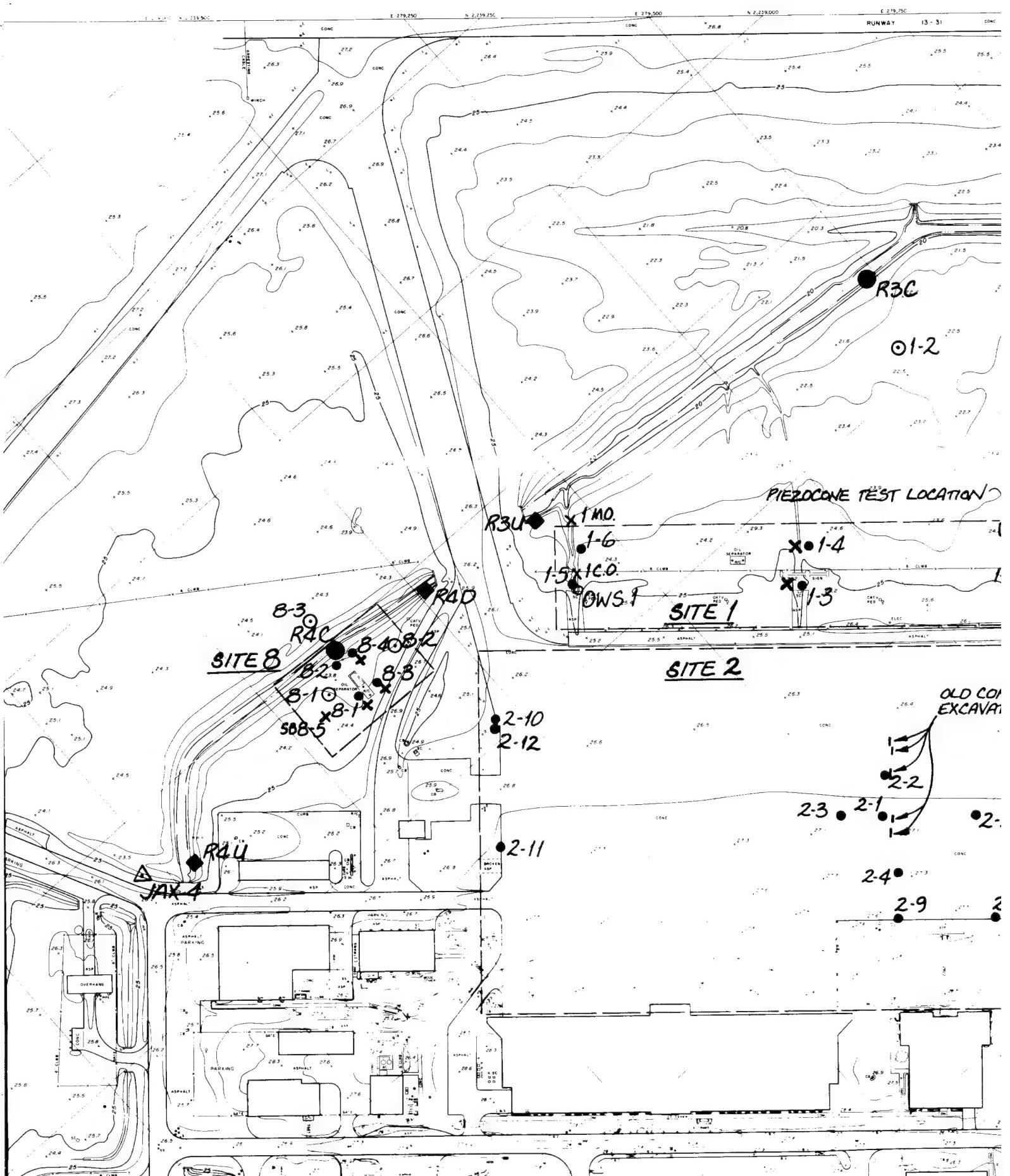
$E_i$  = Daily intake of the  $i^{\text{th}}$  chemical (mg/kg-day)

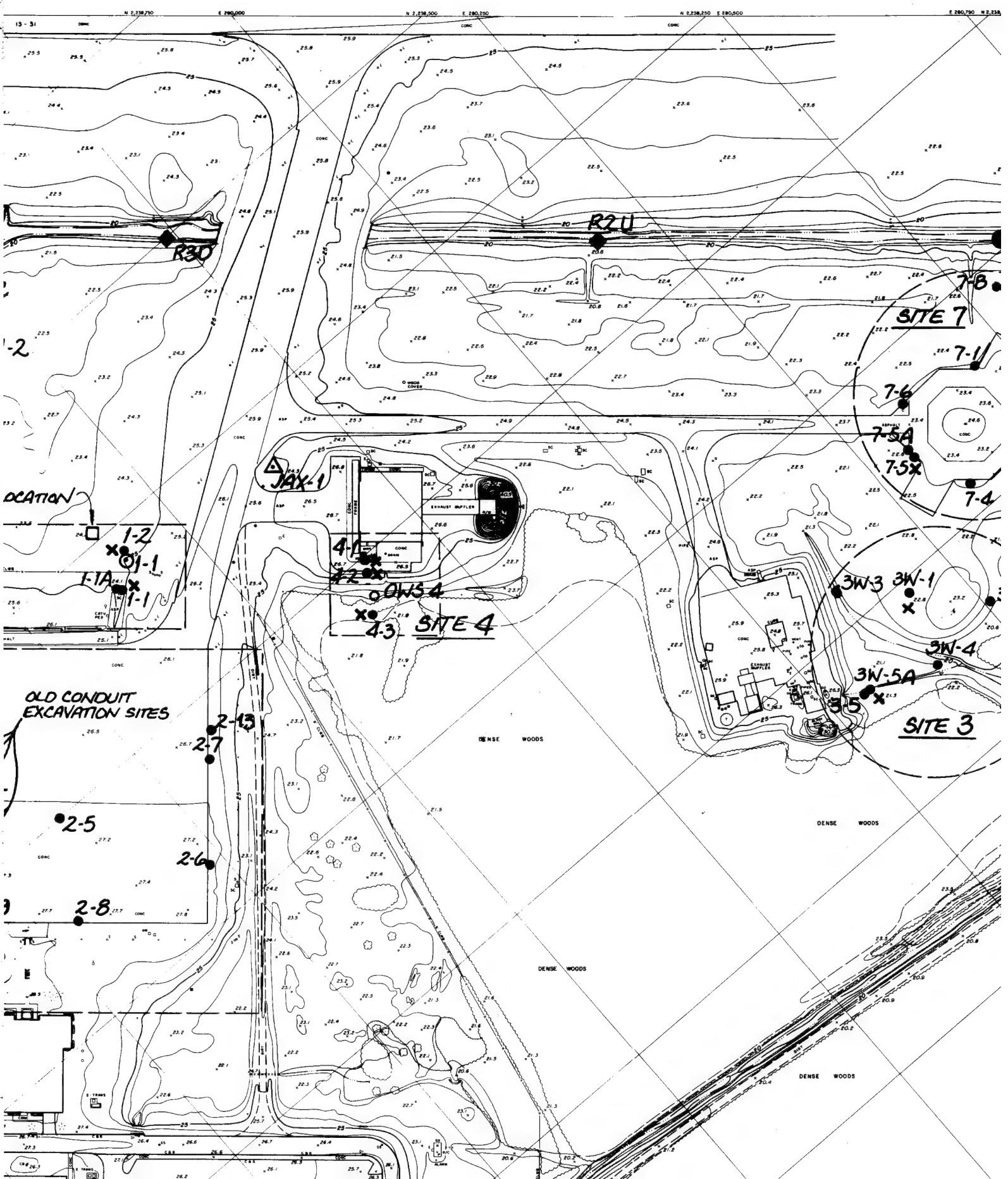
$RfD_i$  = Reference dose of the  $i^{\text{th}}$  chemical (mg/kg-day)

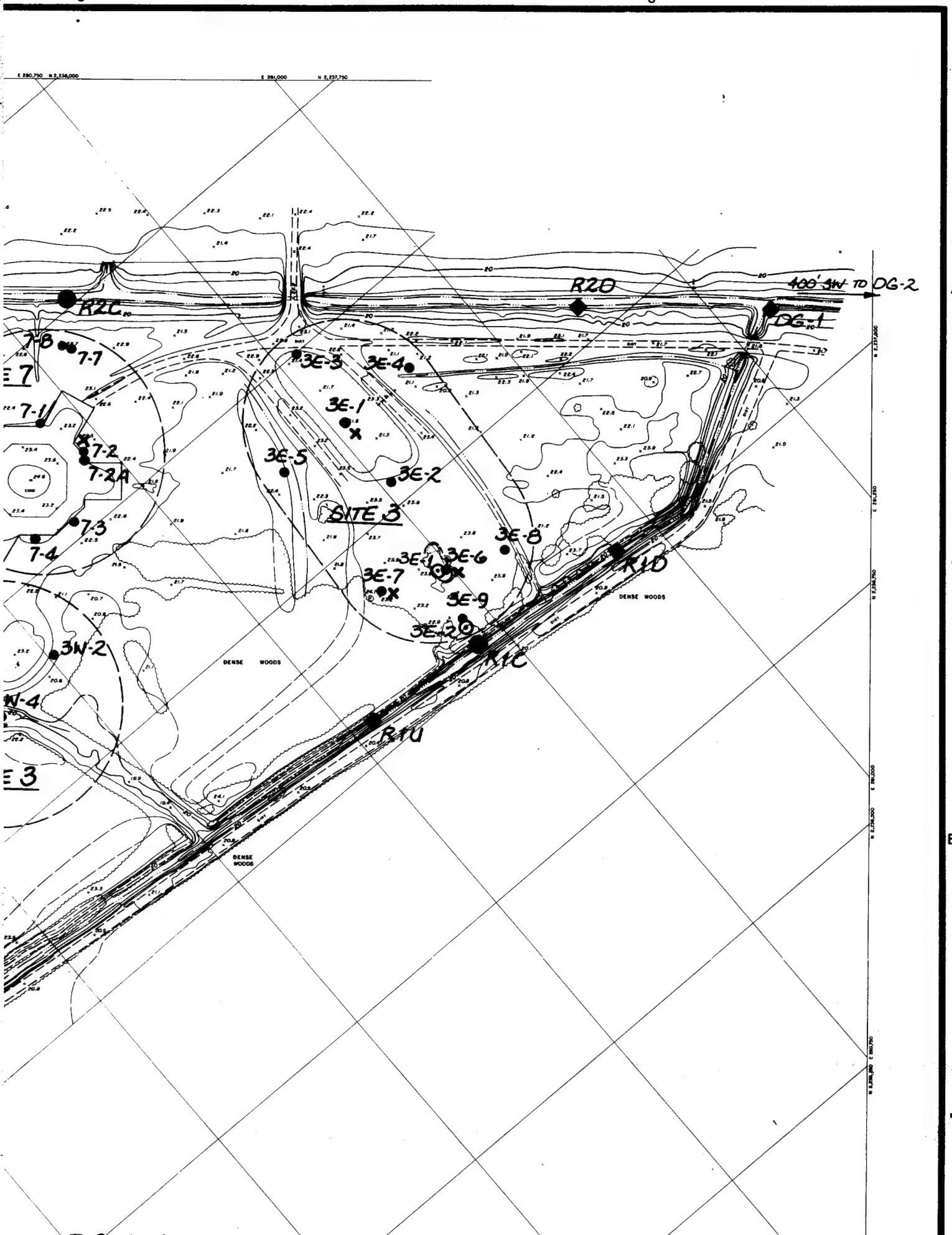
An HI that exceeds 1 is a numerical indicator of the transition between acceptable and unacceptable exposure levels, and there may be concern for potential health effects. Any single chemical with an estimated daily intake greater than the corresponding reference dose will cause the HI to exceed 1.

For multiple chemical exposures, the HI can exceed 1 even if no single chemical exposure exceeds the reference dose for that chemical. The assumption of additivity is most properly applied to chemicals that induce the same effect by the same mechanism or in the same target organ. If the HI is near or exceeds 1, the chemicals in the mixture are segregated by critical effect or target organ and separated indices are derived for each effect or target organ. If any of these separate indices exceed 1, then there may be a concern for potential health effects. Chemicals that are essential nutrients are excluded from the index when in the range of essentiality.









A

B

6-6

• 10-4

SITE

6-5

6-2  
x

4

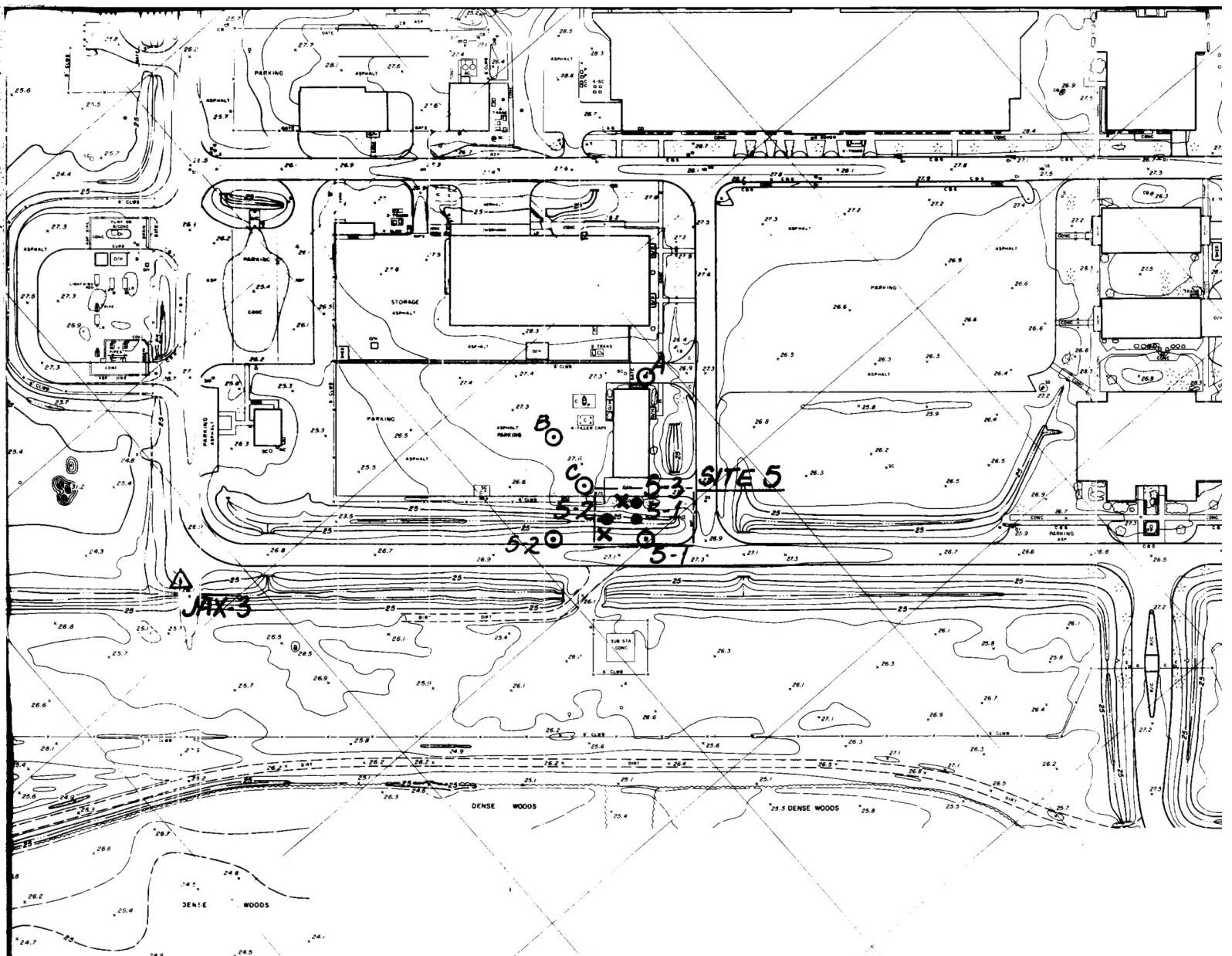
6-5

The diagram shows a site plan for Site 6-2. It features two main structures. The upper structure, labeled 6-2, has a rectangular footprint with a central area labeled 'CONCRETE'. The lower structure, labeled 6-2-1, also has a rectangular footprint and contains a circular area labeled 'ASPHALT'. A horizontal line connects the two structures. Various dimensions are indicated: 27.6, 27.5, 27.7, 27.8, 27.9, 28.0, 28.1, 28.2, 28.3, 28.4, 28.5, 28.6, 28.7, 28.8, and 28.9. Labels include 'X-axes' at the top right, 'CONCRETE' inside the upper structure, 'ASPHALT' inside the lower structure, and 'CONC' at the bottom right.

OVERLAY IDENTIFICATION	<u>COMPO</u>
PROJ NO.	<u>OVERLA</u>
CONTRACT	<u>SCREEN</u>

The logo consists of the letters "CHM HILL" in a bold, sans-serif font. The letter "H" is stylized with a vertical bar on the left and a diagonal bar extending from its top right corner. A registered trademark symbol (®) is positioned to the left of the "C". The entire logo is set against a dark background.

DSGN	R. WESSELLS	
DR	R. WESSELLS	
CHK		
APVD		NO. D

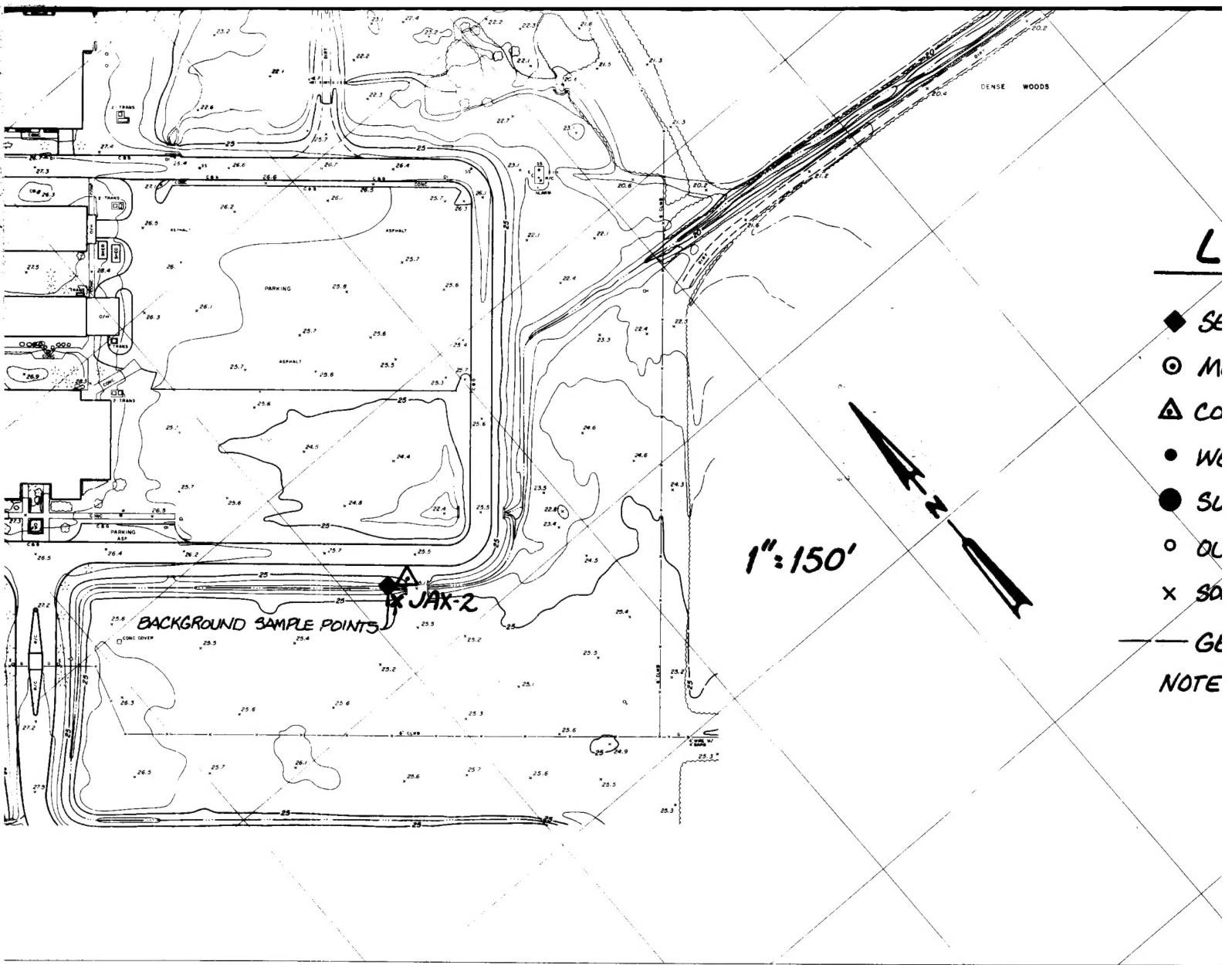


NOV. 6, 1982



ELEVATIONS BASED ON NATIONAL GEODETIC  
250FT. GRID BASED ON FLORIDA RECTANGULAR

LS					
LS					
NO.	DATE	REVISION	BY	APVD	



CONTOUR INTERVAL 1 FT.

200 300 400 FT

ONAL GEODETIC VERTICAL DATUM OF 1929.

DA RECTANGULAR GRID SYSTEM.

VERIFY SCALES

BAR IS ONE INCH ON  
ORIGINAL DRAWING.  
0 [REDACTED] 1"  
IF NOT ONE INCH ON  
THIS SHEET, ADJUST  
SCALES ACCORDINGLY.

125<sup>TH</sup> FIGHTER INTERCEPTOR GROU  
FLORIDA AIR NATIONAL GUARD  
JACKSONVILLE, FLORIDA

## LEGEND

- ◆ SEDIMENT SAMPLE LOCATION
- ◎ MONITOR WELL
- △ CONTROL POINT (VERT = NGVD, HORIZ = STATE PLANE COORD.)
- WELL POINT
- SURFACE WATER & SEDIMENT SAMPLE LOCATION
- OUTFALL WATER AND/OR SEDIMENT SAMPLE LOCATION
- × SOIL SAMPLE LOCATION

### GENERAL SITE OUTLINE

NOTE: BASE MAP FROM F.A.N.G. DATED NOVEMBER 6, 1982

GROUP  
YARD  
?

## SAMPLE LOCATIONS FOR THE SI

SHEET
DWG NO.
DATE DEC 1989
PROJ NO. GNV27267.JX